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EDITED BY

DR. E. M. WALKER,

Biological Department,
UNIVERSITY OF TORONTO, TORONTO

Editor Emeritus: REV. C. J. S. BETHUNE.
ONTARIO AGRICULTURAL COLLEGE, GUELPH, ONT.

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LIST OF CONTRIBUTORS TO VOL. XLVII

AINSLIE, GEORGE G.	Washington, D. C.
ALEXANDER, DR. C. P., Cornell University	Ithaca, N. Y.
BAKER, A. W., Ontario Agricultural College	Guelph, Ont.
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FURTHER NOTES ON ALBERTA LEPIDOPTERA, WITH DESCRIPTION OF A NEW SPECIES.

BY F. H. WOLLEY DOD, MIDNAPORE, ALTA.

(Continued from Vol. XLVI, p. 403.)

603. **Hadena violacea** Grt.—A specimen taken at Banff on Sept 20th, 1901, by Mr. Sanson. I have also a few British Columbia records.

604. **Hyppa indistincta** Sm.—I took a female at light at the Laggan Chalet on July 18th, 1907. It agrees with the figures and description of the female type from Mt. Hood, Oregon, which I have seen in the Brooklyn Museum. This was stated to be a male in the description. I have a similar female from Kaslo, and have seen others in Mr. Cockle's collection. Dr. Dyar records the species as *indistincta* in the Kootenai List, but suggests that both *brunneicrista* Smith and *rectilinea* Dyar (not Esper), from Alaska, are the same thing.

As to the distinctness of *brunneicrista* I have little doubt. *Indistincta* wholly lacks the rusty fulvous marks characteristic of that species, and the terminal line in both my specimens is slightly angulated in the submedian interspace, where it is preceded by a blackish crescent-shaped cloud edged with a few chocolate brown scales of the same shade as the lower portion of the median area. In this respect it resembles *xylinoides* rather than *brunneicrista*, which lacks the black crescent-shaped cloud in the submedian interspace, in which the rusty fulvous shade is paler than any of the brown shades on the wing. The angle, however, does not seem obvious in Smith's figure, and may be variable. The maculation of *indistincta* is, as its name implies, less distinct than in the others, and the general colour more dull and even, without the contrasting white. In my Laggan specimen the black line on the collar is incomplete centrally, but in the Kaslo example the collar is damaged. No such line is referred to in the description. The wing form is that of *brunneicrista*, and shorter than *xylinoides*.

I have examined the Alaskan specimens in the Washington Museum, which were referred to *rectilinea* by Dyar. I should call them *indistincta*. Of the five specimens, only one is a male, and that lacks antennæ. That is most unfortunate, as I have seen no other male which I could call *indistincta*, and the other three North American Hyppas, which include the No. 177 of my Calgary list, are separable from each other by male antennæ. European *rectilinea* is nearest my No. 177 on both antennal and other characters.

605. **Helotropha reniformis*** Grt.—Taken at High River by Mr. Thomas Baird, in 1912.

606. **Momaphana comstocki** Grt.—A fine male, taken, I think, on an electric light pole at Edmonton on May 13th, 1914, by Mr. Valentine Fernekes, to whose generosity I am indebted for the specimen. The type in the British Museum is a much worn male from New York, and there is also a good female there from Orillia, Ont. Hampson gives a wood-cut of the type, but the black markings there shown are too numerous and too intense. Making allowance for that, the Edmonton specimen agrees so well with the wood-cut, Hampson's description, and my notes, as to make me feel confident in the determination. Another type is said to be in the Cornell University at Ithaca, N. Y. The species appears to be very rare everywhere.

A species which has for many years passed under this name in B. C. collections, was described as *Feralia columbiana* by Smith in CAN. ENT., XXXV, p. 9, Jan., 1903, from two males, one from New Westminster, B. C., from Dr. Fletcher, and the other from "North West Territory," from Dr. Ottolengui. A figure of the type is in the British Museum, and is copied by Sir George Hampson. The green of my only two specimens of *columbiana*, which are males, is much darker than that of *comstocki*, and in this and most other characters of colour and pattern, Smith's species has, as he pointed out in the description, more resemblance to *jocosa* than to *comstocki*. The orbicular and reniform of *comstocki* are larger and the wings wider in proportion to their length. As to the generic characters, I do not feel quite sure that the proboscis of my *columbiana* is non-functional, as that of *jocosa*

*Not verified.

appears to be, though Mr. Day tells me that he is not aware that the species has ever been taken either at treacle or sallows. And as to veins 6 and 7 of secondaries arising from upper angle of cell in *Feralia*, as described by Hampson, they do in one of my *columbiana*, but in the other are most distinctly stalked.

607. **Homohadena infixa** Walk.—Very rare. I have only three Alberta specimens in the collection. A female, head of Pine Creek, July 23rd, 1901; a male from the Red Deer River, July 6th, 1905; and a male from Edmonton, May 14th, 1910, the latter taken by Mr. F. S. Carr, at light. The female was included in my original notes under *badistriga* (No. 181). Walker's type of *infixa* is a badly worn male from Florida. Type *kappa* Grt. is a male from Kansas, and apparently the specimen figured by Hampson. They appeared to me to be the same species. I have eleven specimens from Cartwright, Man., and have labelled one of these as very like type *kappa*.

Dinalda Smith was described in Journ. N. Y. Ent. Soc., XVI, p. 94, June, 1908, from a male from Winnipeg, and a female from Sandy Lake, Newfoundland, both in the Rutgers College collection, where I have seen them. The male is labelled July 19th, 1897, apparently by Mr. Hanham. I made no comment on the female, so presumably accepted them as one species. I noted that the male was a small gray species, and probably the same as that in my collection from Manitoba, which I had compared with the type of *kappa*. Messrs. Barnes and McDunnough figure a Southern Manitoba female in their Contributions II, No. 1, Pl. XI, fig. 14, as *dinalda*, concerning which they say on page 24: "Probably this species, judging from the description; we have not seen the type. It is probably identical with *fifia* Dyar, from Kaslo, B. C., which we do not know." I feel confident in referring *dinalda* to *infixa*, though typical specimens of *infixa* are rather larger and browner, as are some of my Manitoba series.

Fifia Dyar was described in CAN. ENT., XXXVI, p. 30, Feb., 1904, from two specimens from Kaslo, as a variety of *badistriga*. I saw a female type at Washington, and noted that it was a species strange to me, though I had previously had a Manitoba specimen of *infixa* labelled "*badistriga* var. *fifia*" by Dyar himself.

I have no Kaslo specimens of any Homohadena in my collection, and have always been in doubt as to the identity of *fifia*. But if I am to accept Dr. Dyar's identification, which would not seem unreasonable, that would make *fifia* a synonym of *infixa*, and distinct from *badistriga*, from which latter I have always been inclined to dissociate it. Hampson's published figure of *fifia* is from a figure sent him of the type, and may be misleading. I have compared my Calgary female *infixa* with the same figure from which Hampson's was taken, and my note is: "Extremely like figure of *fifia* in British Museum, but more even on costa and with darker thorax." The evidence, therefore, seems to point to *fifia* being *infixa*, but at present I must leave the matter open. Holland's Plate XXI, fig. 1, is *infixa*, and not *badistriga*, as stated. *Badistriga* is much more strigate, and has the transverse lines more deeply curved.

In the Rutgers College collection I saw a photograph labelled *retroversa* Morr., presumably of the type in the Tepper collection. My note on this says: "It looks to me almost exactly like the male type of *dinalda* Smith," with which I compared it. In that case Hampson's figure under *retroversa*, which is copied from a figure of a specimen in the U. S. National Museum, can hardly be correct. Barnes and McDunnough have a coloured figure of type *retroversa*, described, I believe, from Missouri, and figure a specimen from that state as agreeing with it. (Contr. II, No. 1, pl. XI, fig. 11.) I have Manitoba and Alberta specimens of *infixa* resembling their figure very closely indeed. I dare comment no further.

608. **Oncocnemis regina** Sm.—Described from a male from Regina, the capital of Saskatchewan. The capture is attributed to the late Dr. James Fletcher, but may really have come from Mr. T. N. Willing. I have seen the type at Rutgers College. Mr. J. B. Wallis took a female at Lethbridge, Alta., on Aug. 21st, 1912, which I have examined and compared with the description, and judged to be this species, though it appeared to be much darker and less maculate than the type. Barnes and McDunnough, in Contr. I, No. 4, pl. III, fig. 20, figure as *regina* a Eureka, Utah, specimen, remarking: "Probably this species, though most

of our Utah specimens are decidedly suffused with pink on primaries." I have seen a large number of the species which they figure, and from the same locality, and should call it a rather pale form of *hayesi*, as I understand that. I have seen neither type nor description, but a Colorado specimen from the Grote collection is in the British Museum, and is figured by Hampson. It is much more ochreous than any of the seven Utah specimens in the collection, but I have a Gunnison, Colo., male which scarcely differs from Utah specimens in my series. It is not improbable, however, that *regina* may turn out to be but a pale form af *hayesi*, to which it is, at any rate, very closely allied.

609. **O. barnesii** Sm.—A female taken at Banff, on Oct. 17th, 1910, on an electric light pole, by Mr. Sanson. The specimen was rather worn, but agreed with the description of this species.

610. **O. levis** Grt.—Lethbridge, Alta. One pair, Aug. 24 and 26, 1912. Taken by Mr. J. B. Wallis, to whom I am indebted for the male.

611. **O. glennyi** Grt.—A male labelled Laggan ("B.C." in error, as usual), 5,000 ft., July 28th, is in the Rutgers College collection, and agrees with Sir George Hampson's figure of the type from Colorado. The specimen very likely came from Mr. Bean.

612. **O. chandleri** Grt.—A male from High River, but without date, taken by Mr. Thomas Baird, I have compared with the type of this species, from Colorado, in the British Museum. The type is paler and grayer, and a trifle ochreous, which mine is not. Another male came to light here on Aug. 29th of the present year (1914). A male taken at Lethbridge on Aug. 27th, 1912, by Mr. J. B. Wallis, and in his collection, is similar.

613. **O. figurata** Harv.?—A female from Lethbridge, July 8th, by Mr. J. B. Wallis. I have compared it with the type of *figurata*, from Nevada, in the British Museum. It differs in being more even in colour, in having the transverse lines more constricted in the submedian interspace, where they are joined by a diffuse black blotch instead of a fine line, and in entirely lacking

the fine black longitudinal streak from the cell to the termen near the apex. It differs similarly from Colorado specimens which stood under *figurata* in the Smith collection, and from the Eureka, Utah, specimen, figured as such by Barnes and McDunnough in Contr. I, No. 4, pl. III, fig. 22. That figure appears to have a black collar not possessed by either my specimens nor by the type, though mine has a blackish head. The tegulæ are disarranged as a result of papering, and may be dark inferiorly. The fore tibiæ have a large claw on the inner side, and a small one on the outer, as Hampson says of type *figurata*.

614. **Platagrotis speciosa** Hbn. var. **arctica** Zett.?—I have two Alberta specimens which I refer doubtfully to this form. A male which I took at the Chalet lights at Laggan, on July 14th, 1904, and a female which turned up at treacle on Pine Creek on August 16th of the same year. I submitted both to Dr. Dyar some years ago, and he called them *speciosa*. A similar male taken by Mrs. Nicholl in Wilcox Pass during 1907 is in the British Museum, and has been recorded as *speciosa* var. *arctica*, by Sir George Hampson in Can. Ent. XL, p. 102, March 1908. The species has long been known in Northern Europe, and both names were first applied to European forms. The typical form in Europe is, as Hampson describes it, "gray white, strongly irrorated with black-brown." Against var. *arctica* in Staudinger's catalogue is a note in Latin, which translates: "smaller, darker, with hind wings nearly unicolorous." Sir George Hampson says of var. *arctica*: "small and dark, with the markings indistinct—Alpine and Arctic." Walker's type of *mixta* is a female from St. Martin's Falls. My note describes it as "gray, black-sprinkled," and, regarding more of the British Museum series continues: "Others, Hudson's Bay and White Mountains, are much like it, and rather smaller only than the usual run of European examples." I have European specimens in my collection which I picked from a series submitted to me to show the considerable variation, and one from Labrador, probably collected by Möschler, sent me by Bang Haas, as var. *arctica*, is more plainly maculate and not nearly as dark as some of those. The Alberta specimens differ in being of a much more bluish dark gray throughout, and in bearing a peculiar resemblance, as regards the primaries, to

Scotogramma perplexa, which occurs also both at Laggan and on Pine Creek, and with which I formerly confused them, before noting the very different generic characters.

I have seen in the British Museum Morrison's male type of *perquiritata* from Mt. Washington, but have no further note thereon.

615. **P. gelida** Sparre-Schneider, var. **mevesi** Auriv.?—I have examined four specimens, all males, taken at Banff by Mr. Sanson, which I refer doubtfully as above. Dates are Aug. 19th, 1909; Aug. 19th, Sept. 1st and 5th, 1911. One of these is in my collection. The others are in that of Mr. Sanson, and one of these I have compared with the British Museum material. On the strength of that comparison I recorded the species as *sincera* H.-S. in 43rd Rept. Ent. Soc., Ont. (1912), p. 119, 1913, notwithstanding that, as there stated, I found the form to resemble more closely some specimens standing under *gelida*. *Sincera* is European, and stands in our North American lists as from Labrador. Hampson adds: "U.S.A., mountains of northern and middle states." *Gelida* has not previously been recorded from North America. In January of the present year (1914), I again examined the British Museum series under both names, though I had then no Banff specimen with me. From my notes I conclude that a specimen standing as "ab. *mevesi* Auriv." from Bergen, Norway, agreed with the Banff form better than did anything else there, and so tentatively I record it. Comparing it with typical *gelida*, Hampson says of *mevesi:* "Browner: fore wing without the pinkish patch on the reniform; hind wing more irrorated with brown." Hampson refers both *gelida* and *sincera* to *Anomogyna* Staud., with which the present form agrees structurally.

616. **P. imperita** Hbn.—Calgary July 23rd, 1908, at light; and Didsbury Aug. 5th and 8th, 1905; all taken by by Mr. C. G. Garrett. Banff, July 30th to Aug. 4th, four specimens, by Mr. Sanson. One Calgary and two Banff specimens are in my collection. One of these I have compared in the British Museum, and have labelled it as being like Labrador specimens there standing, and smaller only than the female type *discitincta* Morr. from St. Martin's Falls. Hübner's figures, which I have carefully

examined, were from Labrador specimens. A Rama, Labrador, specimen in my collection, from Prof. Smith, is slightly smaller than the local series, and differs in being less blue-gray, and a trifle ochreous.

617. **Protagrotis nichollæ** Hamps.—(Can. Ent., XL, 102, March, 1908). Described from Alberta and B.C. material taken by Mrs. Nicholl. The male type is from Simpson River, 7,000 ft., Aug. 13th, 1904, and the female type from Glacier, 4,100 ft., Aug. 3rd, 1907. Both localities are in B.C. The rest are four Alberta specimens, three males and a female, Wilcox Peak, July 29th and 31st, 1907, and Brobokton Creek, Aug. 12th, 1907. I am not aware that I have ever seen any other specimens. The impression received after viewing the specimens on two different visits, was that the species somewhat resembled a large *Scotogramma* near *promulsa*. Hampson places the genus *Protagrotis* after *Euretagrotis* and *Rhynchagrotis* at the end of his vol. IV.

618. **Semiophora elimata** Guen.—Banff, July 28th, 1910. One male. N. B. Sanson. The specimen is near the var. *badicollis* Grt. as diagnosed by Hampson, that is having the black markings strong. I have seen neither the type nor description of that form. For a further note on this species, vide Ent. News, XXIV, 359, Oct. 1913.

619. **Setagrotis vernilis** Grt. syn. **filiis** Smith.—(Smith, Trans. Am. Ent. Soc., XXXIII, 127, April 1907; Dod, Ent. News, XXIV, 361, Oct. 1913, re syn.) Banff, Aug. 14th—Sept. 11th, 1910-11, Sanson. Laggan, Aug. 9th, in Prof. Smith's collection, probably from Mr. T. E. Bean. Grote's type is a male from Colorado in the British Museum, and one of my Banff specimens agrees with it exactly. Smith described *filiis* from a single male from Pullman, Washington. When I first saw the type in his collection I took it for an unusually dark blue-gray form of *infimatis*. At that time I did not know *vernilis*, as the species which I had standing wrongly under that name in my collection, and which I recorded as *vernilis* in 41st Rept. Ent. Soc. Ont., 1911 (the "Entomological Record" for 1910, p. 10), was *vocalis*.

(To be continued).

GEOMETRID NOTES — REVISION OF THE GENUS HYDRIOMENA HUB., GROUP WITH LONG PALPI.

BY L. W. SWETT, BOSTON, MASS.

This group may be distinguished from the groups with short and moderate palpi by the greater length of these appendages, which are beak-like; the slightly larger size and the slighter variability in colour. The prevailing shades seem to be olive-green and white with variations of black and less of the red, except in *Hydriomena ruberata* Freyer. I have regarded *H. speciosata* Pack. as typical of this group, because it is less confused in general collections than the other species.

14. **Hydriomena speciosata** Pack., (Proc. Boston Soc. Nat. Hist., XVI, p. 22, 1874; Monog., p. 102, 1876).

This large, showy, green and white, mottled species is fairly well known to the average collector. The long beak-like palpi are typical of this group. The specimen figured by Packard in the Monograph (Pl. VIII, fig. 37) is a variety and not the one from which the original description was drawn. I have limited the type to the one from which the original description was drawn, there being two distinct forms before him at that time. The type is the green form with white mottlings and the one figured in the Monograph is the black-bordered variety, which I described in the Can. Ent. as *Hydriomena speciosata* Pack., variety *agassizi* Swett (vol. XLII, p. 277, Aug. 1910). The normal form of *speciosata* I have from British Columbia and California and I should not be surprised if it had quite an extended range even through South America as there are several closely-related forms figured in the Biologia Cent. Amer. The typical *speciosata* is dark olive-green with a white ground colour and five black bands crossing the fore wings, and has black dots at the ends of the veins and a black apical streak. The margin of the fore wing is greenish where in the variety *agassizi* it is intense black. The

hind wings of both are dark and smoky. The types (2 ♂, Mendocino City, Calif., Alexander Agassiz) are in the Museum of Comparative Zoology, Cambridge, Mass. It is a rather rare species but Mr. E. H. Blackmore, of Victoria, B.C., took a nice series, the dates of capture ranging from June 29 to Aug. 10, 1913.

Hydriomena speciosata, var. (a) **agassizi** Swett, (Can. Ent., vol. XLII, Aug. 1910). This is the form figured by Packard in the Monograph, Plate VIII, fig. 37, under *speciosata*, to which I have just alluded. *Agassizi* seems to be a variation towards melanism, the entire outer border being black, with green and white mottlings. The central band is twice as wide in *agassizi* as in *speciosata* and the whole insect has a black appearance. It is evidently a rare variety as the type is the only specimen I have seen. The type (1 ♂, Mendocino City, Calif., Alexander Agassiz) is in the Museum of Comp. Zoology, Cambridge, Mass.

Hydriomena speciosata, var. (b) **taylori** Swett, (Can. Ent., vol. XLII, p. 277, Aug. 1910).

This seems to be a colour variety of *speciosata* in which the green and white is replaced by a brownish-olive. It seems to be local, as I have never seen it from any place but Vancouver Island, where it has been taken at Nanaimo and Victoria. The type was submitted to me by the late Rev. G. W. Taylor, as he was uncertain of the characters of the true *speciosata*, having been misled by the figure of one form and the description of another.

Type, 1 ♂, July 22, 1908, from Rev. G. W. Taylor, Departure Bay, in my collection. Cotype, 1 ♂, in the collection of Mr. A. J. Croker, July 1, 1909, Victoria, B.C. Other specimens from Victoria, July 3, 1913, have been received from Mr. E. H. Blackmore.

15. **Hydriomena costipunctata** Barnes and McD. (Contrib. to Nat. Hist. of Lepid. of North America, vol. 1, no. 5, p. 33, July 1912; plate II, fig. 14).

This form is closely allied to *speciosata* and also to some of the Mexican species, but Dr. Barnes, with his large series, has no doubt been able to see the distinguishing characters. Personally, I regard it as a variety of *speciosata* Pack., the figure, as judged by plates, are sometimes rather unreliable as they do not bring out the minute differences. It has a purple-brown ground colour and apical patch and lacks the median white shading of *magnificata*. It may be that *H. magnificata* Taylor belongs to the group with long instead of the group with moderate palpi as I listed it. When I was working on this group the Rev. G. W. Taylor sent me a photograph of his type but the palpi were blurred and appeared to be of moderate length. Shortly after this I wrote him about the matter, but unfortunately illness prevented him from replying. Now that his collection has passed into Dr. Barnes' hands I can ascertain its position from the latter.

H. costipunctata, according to the colour, must be close to var. *taylori* Swett.

Types, 1 ♂, 1 ♀, Tucson, Ariz., in the Barnes collection.

16. **Hydriomena barnesata** Swett, (Can. Ent., vol. XLI, July, 1909; Barnes and McD., Contrib. Nat. Hist. Lepid. North Am., vol. 1, no. 4, 1912; pl. XIV, fig. 19-22).

This species has very long palpi, possibly the longest of the group, and the general appearance is different from any of the others. The broad smoky mesial band with its three black lines, and the clear white mesial space beyond make it resemble in a way some of the German varieties of *autumnalis* with pointed or elongated wings. The general colour is olive-green and white. The hind wings are dark smoky brown. It is a large species and evidently rather rare as I have only seen a few specimens, three from Dr. Barnes and one from Mr. Grossbeck.

Types, 3 ♂ (coll. Barnes, 2 ♂; coll. Grossbeck, 1 ♂), Huachuca Mts.. Ariz. Paratype, 1 ♂, Palmerlee, Ariz., in my collection. Through the kindness of Dr. Barnes, I also have 1 ♀ from Fort Wingate, N. Mex., which does not differ materially from the male.

(To be continued.)

NORTH AMERICAN DIPTERA.

BY J. R. MALLOCH, F.E.S., URBANA, ILL.

The new species described in this paper were taken during a field trip in connection with an investigation of the occurrence of *Simuliidæ* in the southern part of the State of Illinois. The types are deposited in the collection of the Illinois State Laboratory of Natural History. This paper is published by permission of Dr. Stephen A. Forbes, State Entomologist.

The present opportunity may be taken to draw attention to a curious error which occurs in my paper on *Simuliidæ*.* In the last page proof there appeared a period after the word *Simulium* in the first caption of the generic table. In making the change to a comma the compositor, evidently by mistake, took out the last line of table instead of last line of caption I, thus causing the same line to appear twice, and deleting the alternative to caption 2, which should read, "Face broad, basal cell absent....*Prosimulium*, p. 24."

Botanobia hinkleyi, new species.

Female.—Black. Frons reddish brown, slightly obscured by grayish pollen, the anterior fourth pale yellow, surface hairs yellow; ocellar triangle opaque; face obscure, whitish yellow; antennæ brown, the lower portion of third joint, especially towards base and on inner side, yellowish; arista brown; cheeks concolorous with face, obscured with gray posteriorly; clypeus gray; proboscis brown; palpi yellow. Mesonotum black with dense gray pollinosity, which obscures the surface, with the exception of the areas occupied by four longitudinal vittæ, those areas shining; pleuræ black, upper half gray pollinose, lower half highly glossy; scutellum slightly gray pollinose, but shining; thoracic hairs brownish yellow, the bristles black. Abdomen distinctly shining, with but slight indications of dusting; surface hairs soft, white. Legs yellow, black on coxæ except their apices, femora except narrowly at apices, the fore and mid tibiæ at the middle, the hind tibiæ except their bases, and on the apices of the tarsi; surface hairs pale. Wings clear, veins brown. Halteres pale yellow, the stems brownish.

*Tech. ser. No. 26, Bureau of Entomology, April 6, 1914.

Frons slightly less than one-half the width of head, the surface hairs short, though numerous, those on the lateral margins not long, though setulose; triangle short and broad. not reaching to middle of frons, and not half as broad as frons at vertex; antenna with third joint as broad as cheek at middle, which is equal to one-third the height of eye; cheeks with many soft hairs, which are very short, the anterior hair distinguishable, but not vibrissa-like; a distinct ridge traverses the cheek mid way between the eye and the lower margin; eye slightly higher than long, pubescent. Surface of mesonotum unpunctured, the space between the median pair of vittæ impressed; surface hairs numerous, though short, and regularly distributed; bristling normal; scutellum haired as mesonotum, and with four marginal bristles, the basal pair very much shorter than the apical pair, the latter not closely approximated, cruciato; surface of scutellum convex, its outline rounded. Abdomen ovate, as long as thorax. Legs normal. Wing with a distinct break at apex of auxiliary vein, which vein is traceable; first costal division subequal to second, third one half as long as latter; inner cross-vein at a little before the end of first vein; the distance between its upper extremity and the inner cross-vein about three-fourths the length of last section of fifth vein, and one-third as long as last section of fourth; veins 3 and 4 subparallel.

Length 2 mm.

Type locality.—Dubois, Ill., April 24, 1914. Taken by sweeping evergreens (J. R. Malloch).

Paratype.—Same locality. Taken by sweeping. Related to *trigramma* Loew, from which the difference in the thoracic markings, especially, will serve to separate it.

Named in honour of Mr. A. A. Hinkley, the well-known conchologist, on whose ground the species was taken, and to whom we are indebted for much hospitality.

Agromyza aristata, new species.

Female.—Black; thorax very densely covered with pale gray pollen, entirely opaque; abdomen less densely pollinose, slightly shining. Head bright yellow, only the upper third of frons, includ-

ing the ocellar region, and back of head black, with grayish pollinosity; antennæ, palpi and proboscis yellow; arista and head bristles blackish, the former yellow at base. Thorax without pale markings, except below wing base, where it is obscurely yellowish. Legs yellow, including the coxæ. Wings clear, veins brown, fourth and fifth less distinct than the others. Squamæ yellow, fringe concolorous, margin brownish. Halteres yellow, knobs whitish.

Frons about one-half the head width, orbits poorly defined; four pairs of orbital bristles present, which are of moderate strength, the anterior two pairs incurved, the posterior two backwardly directed; frontal triangle not well defined; antennæ of moderate size, third joint disc-like, arista tapering, bare, very short, its length barely exceeding the height of the third antennal joint; cheek at posterior margin as high as eye, at anterior margin about one-half as high, marginal hairs weak and pale, vibrissa black and well differentiated, though not strong. Mesonotum with four pairs of dorso-central bristles, which decrease slightly in strength anteriorly, the anterior pair slightly in front of suture, about five irregular rows of discal setulæ between the anterior dorso-centrals; the pair of bristles between the posterior dorso-centrals of moderate length. Abdomen ovate, penultimate segment short, ovipositor rather short and broad; posterior margins of all segments with distinct bristly hairs, which are most noticeable on the last segments. Legs of moderate strength, their surfaces with short black hairs; mid tibia without posterior bristles. Wings slender; costa indistinguishable from slightly beyond apex of third vein; veins 3 and 4 gradually divergent on their apical portions; fourth vein reaching wing margin at about same distance behind apex of wing as third vein does before apex; auxiliary vein indistinct; inner cross-vein distinctly beyond apex of first, and near to apical third of discal cell; last section of fourth vein about six times as long as penultimate section; last section of fifth vein about four-fifths as long as penultimate section.

Length 2 mm.

Type locality.—Gleason Dune, Havana, Ill., April 30, 1914 (Hart & Malloch).

Paratypes.—Havana, April 30 and May 1, 3 specimens; Golconda, Ill., April 18, 1914, on bank of Ohio River, and St. Joseph, Ill. May 3, 1914, 3 specimens (Hart & Malloch).

Male.—Similar to the female in coloration, bristling and venation. The hypopygium is normal in size and yellowish in colour.

Allotype.—Same data as type.

This species, through its possession of a pale yellow face and frons and the discontinuance of the costal vein, will run down to section 13 in my table of species in this genus,* but may readily be separated from the two species included there as follows: From *brevicostalis* Malloch by the lateral margins of the disc of mesonotum being concolorous with the disc, and from *davisi* Walton by the yellow antennæ. *Parvicella* Coquillett is a much more slender species than *aristata*, and is essentially different in many respects.

The food plant of *aristata* is unknown, the specimens being the result of general collecting in different situations.

Agromyza pruinosa Coquillett.

It may be of interest to record the occurrence of this species at St. Joseph, Ill., on May 3, 1914. The writer took three females on the bank of Salt Fork, by sweeping the branches of various trees. River birch (*Betula nigra*) is recorded only for the southern part of the State, and no birch trees occur at the place where the insect was taken, so that it must feed upon some other tree here. Further investigation may be made to discover its habits in this locality.

Agromyza infumata, new species.

Male.—Black. Head black, frons opaque on centre stripe, orbits and ocellar region shining; apex of proboscis pale brown. Mesonotum shining, but with distinct brownish pollinosity; vertical pleural suture and below wing base brown; squamæ gray, margin and fringes brown. Abdomen shining black, without pollinosity. Legs black. Wings slightly grayish, veins dark brown. Halteres yellow, knobs white.

*Am. Ent. Soc. Amer., Vol. 6, 1913, p. 271.

Frons at vertex about one-half the width of head, at anterior margin slightly over one-third the head width; orbits well defined, five pairs of orbital bristles present, the anterior three pairs incurved, the upper two pairs backwardly directed, all the bristles moderately long but fine, orbital hairs weak; frontal triangle distinct, not reaching to middle of frons; antennæ normal in size, third joint rounded; arista thickened at base, tapering to beyond middle, bare, its length equal to anterior width of frons; face very slightly concave; cheek barely as high as third antennal joint, at its highest point about one-fourth as high as eye, marginal hairs numerous, but weak, vibrissæ differentiated but not strong; eye higher than long. Mesonotum with four pairs of dorso-central bristles; discal setulæ distinct, but not very numerous, about five irregular lines between the anterior dorso-centrals; no bristles between the posterior pair, the setulæ continued to between the latter. Abdomen rather slender, the surface with numerous rather strong hairs; hypopygium normal. Legs with short surface hairs; no posterior bristles on mid tibia. Costa to end of fourth vein, which is almost exactly at wing tip; auxiliary vein indistinct, but complete, not fused with first; veins 2, 3 and 4 distinctly divergent apically; outer cross-vein oblique, its upper extremity in vertical line with apex of first vein; inner cross-vein at middle of discal cell; last section of fourth vein about eight times as long as penultimate section; last section of fifth vein twice as long as penultimate section; sixth vein almost reaching wing margin.

Length 2 mm.

Type locality.—Dubois, Ill., April 24, 1914, taken by sweeping in woods (Hard & Malloch).

This species belongs to the group which is dealt with between captions 28 to 34 in my table of species in Agromyza, above referred to, and is most closely related to *fragariæ* Malloch, from which it may readily be separated by the very different wing venation. This character also serves to distinguish the species from any other in this group, as does also the absence of the mid tibial bristles. Food plant unknown.

SOME CHALCIDOID HYMENOPTERA FROM NORTH QUEENSLAND.

BY A. A. GIRAULT, NELSON (CAIRNS), AUSTRALIA.

The types of the following species are in the Queensland Museum, at Brisbane.

Family TRICHOGRAMMATIDÆ.

LATHROMERINI.

Genus *Lathromerella* Girault.

1. **Lathromerella fasciata** Girault.

Five females of this beautiful species were taken June 3, 1913, by sweeping the forested slopes of Mount Pyramid (from 1,500 to 2,500 feet), Nelson, North Queensland, by Mr. Alan P. Dodd. The metathorax plus propodeum are black on each side having a wide mesial portion concolorous (dorsal aspect). The two ring-joints are verified.

Genus *Lathromeroides* Girault.

1. **Lathromeroides fasciativentris** n. sp.

Female.—Length 1.30 mm.

Exactly similar to the type, *longicorpus* Girault, but the abdomen banded with four or five black cross stripes. The black dot under the stigmal vein is surrounded with suffused blackish. Two ring-joints. Mandibles tridentate.

Male.—Not known.

Described from one specimen captured with the foregoing *Lathromerella*.

Habitat.—Australia, Nelson (Cairns), Queensland.

Type.—The above specimen on a slide. Later, the species was compared with the type of *longicorpus*. It is distinct.

Chaetostrichini

Genus *Neobrachista* Girault.

The antennæ in this genus were wrongly described as bearing but one funical joint; there are two but the first is wider than long and not very distinctly separated, though distinct enough in specimens of the following new species. In the type species, however, it is still shorter and resembles more one of the ring-joints except that it is wider and is intimately connected with the

funicle. The genus is distinguished from *Brachistella* and *Abbella* by its very short marginal vein, and its long, slender stigmal. It is gratifying to me to be able to throw light on this point.

1. **Neobrachista novifasciata** n. sp.

Female.—Length 1.00 mm.

Closely allied with the type species, *fasciata* Girault, but more robust, the abdomen broader (a little wider than the thorax, distinctly narrower in *fasciata*), and with but three black stripes across it, one a little out from base, the second a little distad of the middle, and the third a little distad of the mid-distance from the second to apex. The first funicle joint is a little longer and more distinct (yet not quite half the length of the second which is a little wider than long; in the type species the first joint is only about a fourth the length of the second which is a little longer than wide). Second, black stripe of abdomen interrupted at the meson, the others continuous and straight. Mandibles tridentate. Also the fore wings are shorter and broader, subtruncate at apex (bearing about 26 lines of discal cilia across the widest point). Fore wings slightly clouded, more distinctly under the stigmal vein and along the venation. Thorax with a *distinct* median sulcus (not present in the single specimen of the type species before me though slightly indicated in places, nevertheless plainly absent), as deep as the parapsidal furrows.

Male.—Not known.

Described from a single specimen captured with the above *Lathromerella*.

Habitat.—Australia, Nelson (Cairns), Queensland.

Type.—The above specimen on a slide with two ♀'s of *Lathromerella fasciata* Girault.

Family MYMARIDÆ.
Genus *Polynema* Haliday.

1. **Polynema zolai** n. sp.

Male.—Length 1.50 mm. Large.

Jet black, the wings hyaline, the venation black, also the antennæ (but the pedicel brown) and the legs except the tarsi, knees, tips of tibiæ and all of cephalic tibiæ which are brown. Characterized by the wings which are broad, subtranslucent and

with short marginal fringes the longest of which are only about a sixth the greatest wing width; only about twelve lines of discal ciliation which is scattered, most numerous cephalo-distad and practically absent over all of the proximal half of the blade which is about two and a quarter times longer than broad. Antennæ longitudinally striate, the joints shortening distad, the proximal joint of funicle as long as the second, somewhat brownish, the club joint a little longer than the distal funicle joint which is about a fourth shorter than joint 1 of the funicle, the latter about 2½ times longer than wide at the base. A very short, narrow, minute ring-joint is present.

Female.—Not known.

Described from one male specimen given to me by Mr. A. P. Dodd, who captured it by sweeping the edge of jungle, May 20, 1913.

Habitat.—Australia, Kuranda, North Queensland.

Type.—The above specimen on a slide.

Respectfully dedicated to Emile Zola for his "La Débacle," wherein the horrors of war are ably pictured to us.

2. **Polynema speciosissimum,** n. sp.

Female.—Length 1.50 mm. Large, the fore wing banded.

Black, the head except the dusty vertex, the prothorax and mesonotum reddish brown. Petiole of abdomen, coxæ, cephalic femora, all trochanters and proximal half or more of all tibiæ, white. Tarsi reddish brown, also the scape and pedicel. Funicle joints 4 and 5 white, antennæ and legs otherwise black, except tips of front tibiæ, which are yellowish. Fore wings banded as in *franklini* Girault, but the cross-band is very intense jet black and decidedly longer, distinctly less than its own length from the apex of the venation. Scape not distinctly sculptured, the first funicle joint elongate but only ⅔ the length of the second, which is very long, subequal to the third, both longest; joint 1 longer than 6, subequal to 4, which is slightly longer than 5 (funicle). Cross-band of fore wing followed by a broad, naked area from margin to margin, the black band itself one and a third times longer than wide (cephalo-caudad). Sculpture inconspicuous. Discal cilia in the black band very dense and longer than the fine, shorter,

less dense ciliation distad, the longest marginal cilia about three-fourths the greatest wing width.

Male.—Unknown.

Described from a single female captured by sweeping in a jungle-pocket, June 4, 1913. This species is certainly one of the most remarkably coloured mymarids known.

Habitat.—Australia, Nelson, North Queensland.

Type.—The above specimen on a slide.

Genus *Gonatocerus* Nees.

1. **Gonatocerus competi** Girault.

A single very pale female of this species was taken on May 29, 1913, at an elevation of 1,500 feet, forest, Nelson, North Queensland. A round spot is present on the base of the scutellum.

(To be continued.)

A NEW GENUS AND A NEW SPECIES OF LEPIDOPTERA FROM ARIZONA.

BY WM. BARNES, M.D., AND J. McDUNNOUGH, PH.D., DECATUR, ILL.

Having had occasion to examine the types of the species described as *Mamestra antonito* Barnes (Can. Ent., vol. 39, p. 14, 1907), we were surprised to find that the ♂ and ♀ types represented respectively two entirely different species, structurally widely apart, neither of which could remain associated with the genus *Mamestra*, or *Polia*, as it is now called by Hampson.

The ♂ type, labelled *Barathra antonito*, which we figured in our "Contributions," vol. I, no. 4, pl. VI, fig. 6, and from which the original description was drawn, has hairy eyes, a fact which led to its being placed in *Mamestra;* the mid and hind tibiæ are, however, distinctly spined, which would throw it into Hampson's subfamily *Agrotinæ*, and associate it with the two genera, *Ala* Staud. and *Trichorthosia* Grt., the only two described genera combining hairy eyes and spined tibiæ; of these *Ala* contains several Heliothid-like moths from Central Asia which have nothing in common, apart from the above mentioned features, with *antonito* Barnes; *parallela* Grt., the type of the genus *Trichorthosia* is, as the name implies, rather Orthosian in appear-

ance and is further characterized by the flat hairy appressed thoracic vestiture with slight tuft of metallic scaling on metathorax and no abdominal tufting. In *antonito* Barnes the thoracic vestiture is loose and composed chiefly of large spatulate scales; there is a slight divided tuft on the metathorax and a small tuft on the basal abdominal segment; the ♂ antennæ show a rather peculiar structure in that they are very strongly lamellate, each lamella being considerably excavated centrally, the two ends thus projecting far beyond the central portion and presenting to a casual glance the appearance of bipectinations; the fore tibiæ are unarmed, the palpi short, upturned, with 3rd joint rather porrect and the tongue is well developed; the species evidently represents a new generic type for which we would propose the name *Mimobarathra;* besides the ♂ type of *antonito* we have six further ♂'s from White Mts., Ariz., before us from which we have drawn up the above generic characterization. The so-called ♀ type of *antonito* Barnes labelled "So. Arizona, Poling" does not, as already mentioned, belong to this species at all; it has naked eyes, unspined tibiæ, the fore tibiæ however with well developed apical claw on inner side; the thoracic vestiture is composed of loose spatulate scales, but the specimen is too rubbed to determine the nature of the tufting. It would fall into Hampson's subfamily Acronyctinæ and according to his tables belong either to the genus *Copanarta* Grt. or to *Leucocnemis* Hamp. It is apparently undescribed and bears but little affinity to the already described species of either of these two genera, but as the specimen is considerably worn we dislike to create a new genus for it and place it provisionally in *Leucocnemis* Hamp. with following characterization:—

Leucocnemis barbara, sp. nov.

Head and thorax clothed with an admixture of white, black and pale ochreous scaling; primaries white, heavily sprinkled with smoky, the ground colour almost obliterated and only showing distinctly in subterminal area; basal area sprinkled with orange scaling, especially before lower portion of t. a. line, which is black, outcurved and lunulate; orbicular round, orange, with dark centre and black outer line; reniform broad, figure-of-eight-shaped, open above and below, with pale centre broadly margined with

orange, the whole surrounded by black line; t. p. line single dentate, sinuous, black, shaded outwardly above vein 1 with orange, this shading covering entire s. t. space; s. t. line indicated by broken orange scaling on dark blotches; fringes checkered white and black. Secondaries smoky, paler in basal half and slightly hyaline, crossed by an indistinct smoky line. Beneath, primaries smoky, secondaries as above. Expanse 30 mm.

Habitat.—South Arizona (Poling). One ♀.

Type.—Coll. Barnes.

FIELD NOTES AND QUESTIONS.

Interesting New Jersey Captures.

On April 7, 1914, a large Carabid was taken at Arlington, N.J., from a case of Japanese azaleas. Mr. E. A. Schwarz to whom it was sent identified it as *Damaster blaptoides* Kollar and said that it was a rather rare species, the genus being peculiar to Japan. Inasmuch as it is a beneficial insect its introduction into the United States would be desirable.

Eucactophagus graphipterus Champion was taken during April, 1914, in a greenhouse at Summit, N.J. This member of the family Calandridæ was determined by Mr. Schwarz who has the following to say concerning it, "Very interesting; a native of Costa Rica and U.S. of Columbia; only three specimens are known. The one figured in Biol. Centr.-Amer., vol IV, part 7, plate IV, fig. 35, was found by Prof. Britton in a greenhouse at Connecticut, Larvæ and other biological material of this species are greatly desired by the U.S. National Museum, also more information regarding nature of damage to orchids."

HARRY. B. WEISS, New Brunswick, N;J.

Callopistria floridensis Guen. in New Jersey. The work of this insect known as the Florida Fern Caterpillar or the Southern Fern-Cutworm was first noted in New Jersey at Weehawken, Riverton and Rutherford during September and October, 1914, where the larvæ were doing considerable damage to ferns in greenhouses, attacking such species as Adiantum, Cyrtomium, Nephrolepis, Pteris, Polypodium, Blechnum and Asparagus sprengeri. Both forms of larvæ were present with the

green ones largely in the majority, although the black ones were by no means scarce. Handpicking of the caterpillars and shaking of the infested plants supplemented by "swatting" the moths at night with the ordinary wire "fly swatters" gave the best results. Light traps and stale beer and molasses attracted only a few moths. Paris green and hellebore burned the foliage as did arsenate of lead to a slight extent. The chief objection to arsenate of lead was the discolouration of the foliage, which followed its use. Poisoned bran and molasses was not successful, as the larvæ preferred the ferns. A detailed account of this insect can be found in Bull. 125, Bur. Ent. U.S. Dept. Agric., by F. H. Chittenden, and in the 27th Report of the State Entomologist of Illinois which contains an article by J. J. Davis. Inasmuch as neither of these publications mentions the hatching period of the egg, I might say that eggs under my observation hatched in from five to seven days. Considering the fact that it is a troublesome species once it gains a foothold in the fern house, it would pay fern growers to be on the watch for it when receiving plants from other establishments. It can be readily transported in the egg, larval and pupal stages.

HARRY B. WEISS, New Brunswick, N.J.

Priophorus acericaulis MacG. in New Jersey. This saw-fly known as the Maple Leaf-Stem Borer is listed in Insects of New Jersey as being very local and recorded from South Orange. During May and June, 1914, it was found injuring maple trees on the property of Mr. T. Romaine, Hackensack, N.J. The leaves started to drop about May 20th, and in a few days the ground beneath the infested trees was covered. Mr. Romaine had observed this unusual pest for the past four years and during that time it had not spread at all to adjoining maples. An account of its life history by Dr. W. E. Britton can be found in Ent. News, vol. 17, Nov., 1906, and acting on the suggestion contained therein, kerosene emulsion at the rate of one to twelve was applied twice to the ground beneath the trees while the larvæ were entering. It is somewhat unusual to run across the work of this insect which is not by any means common.

HARRY B. WEISS, New Brunswick, N.J.

POPULAR AND ECONOMIC ENTOMOLOGY.

(This is the first of a series of articles, which, it is hoped, will appeal to our amateur readers and those primarily interested in agriculture. They are not offered as original contributions to science, but may incidentally contain new observations.—Ed.).

Some Inhabitants of a Sand Plain in June.*

BY NORMAN CRIDDLE, TREESBANK, MAN.

The locality chosen for this paper is a drifting, undulated sand plain, some two miles in length and not more than half that distance across at its widest point. It is surrounded on three sides by low, sparsely-grassed, sand dunes, not infrequently scolloped out and bare to the south, and having a denser, or even luxuriant vegetation on the north side. Between these ridges are low, undulated valleys, which in early days were thickly wooded, and often contained small ponds. Now much of the larger timber has been destroyed by fire and the ponds are dry. Scattered over all this area, however, are still numerous white spruce, while aspen poplars are again rapidly making their way through the often dense willow scrub.

On the east of our plain is a large bog extending for a number of miles, containing the usual vegetation including larch, black spruce, birch and a variety of small shrubs and plants too numerous to mention.

On the sand plain, itself, with which we are chiefly concerned, are several islands of trees, surrounded, that is, by sand, and upon which are larch, poplars, birch, willow, maple, cherry, etc., while in the valleys sheltered from the actual drift may be found *Elæagnus argentea*, *Arctostaphylos uva-ursi*, *Pctalostemon candida* and *P, villosa*, *Senecio manitobensis*, wild sunflowers aud others.

The sand itself is yellowish-white and on account of constantly drifting, remains permanently wet a few inches below the surface. It is this condition that enables it to support the plants mentioned above as well as a binding grass, *Orizopsis cuspidata*, and two others which grow extensively, namely, a stout form of *Andropogon furcatum* and *Calomovalfa longifolia*.

The date of our trip is June 20th—the locality Aweme, and Province Manitoba.

*Contributions from the Entomological Branch, Department of Agriculture, Ottawa.

Almost the first plant to attract our attention as we climb into the loose sand is the beautiful Veined Dock, *Rumex venosus*. Just now, however, its chief attraction lies in the fact that it harbours three different species of beetles. First there is that bright little Chrysomelid, *Gastroidea formosa*, whose colour is in striking contrast to the sand, but harmonizes, instead, with the plant it feeds upon. Then there is an active, narrow, black beetle, probably *Anthicus monticola* Casey, and lastly a species closely related to the famous Alfalfa Weevil, namely, *Phytonomus quadricollis*. This beetle is very apt to be overlooked unless we inspect the plants closely, its colour both above and below being almost identical with the sand, and then it has a habit of clinging to the stems near their base when it often becomes partly buried by the drift. Lastly, added to its remarkable protective colouration, are its habit of shamming death whereby it may easily be lost among the sand. The larvæ feed upon the plant and later spin silken cocoons among the leaves, where they change to pupæ, and towards autumn to beetles, passing the winter in this stage, presumably buried among the leaves and sand.

Having passed the objects just discussed and climbed upon the sand to where it is level, probably the first object to attract us will be a species of tiger beetle called *Cicindela limbata*, a beautiful little creature which delights in the pure drifting sand with perhaps on odd clump of grass for shelter. It is here in hundreds running actively about and readily taking wing when disturbed; but it is not a strong flier and consequently seems to depend largely upon its protective colours to escape capture, which, however, avails little when man is the hunter. Larval holes are common enough, being more often met with in the valleys where they are somewhat sheltered from the wind. They are quite shallow burrows, in fact, the shallowest of any of our local species. Two sizes occur at this time, those containing larvæ that are about to change to pupæ, and others much smaller which have yet a full year in which to do so.

A collector visiting a situation like this for the first time, and not knowing the habits of tiger beetles, is apt to be disappointed if the day be either unusually hot or cold. For while every

indication points to a profitable hunting ground, there will hardly be a beetle in sight. Experience, however, teaches that appearance is often deceptive, and here we have no exception to the rule. In reality the beetles are merely hiding from heat or cold, as the case may be. Personally, I have found such periods among the most profitable for collecting, as one soon gets to recognize the peculiar little heaps of sand thrown out as a badger would throw it out, with the entrance carefully closed. These heaps of sand are more compact than those of wasps so common here, and are therefore easily recognized. The holes are always on a slant, and can be readily traced by pushing a stalk of grass along them. Then by moving the sand carefully the beetle will be revealed ready to rush out, which it will do and escape too, if one is not careful. Their temporary homes are seldom more than six inches long and are never used more than once. On cold or rainy days, however, they will be occupied until the return of fine weather.

As a rule, tiger beetles retire beneath the ground each night, but occasionally some species at least, acquire that desire for travelling, which is common to nearly all creation in some shape or form and which, of course, is one of the chief factors in the distribution of animals. Then they disregard all their usual habits and with other diurnal insects fly long distances at night, often indeed in the very darkest of nights. Some species of *Cicindela*, however, do this travelling in the day time when, of course, they run a greater risk of falling a prey to birds.

Moving down into a hollow, sheltered by spruce and Wolf Willow (*Elæagnus*), where the sand is no longer drifting, but still shows many bare spots among the sparse herbage, we encounter a form of *Cicindela lecontei* recently described as a new species by Colonel Casey. It is an interesting tiger beetle, varying from greenish-bronze to rich wine colour and usually having the white markings united into a continuous marginal band. It is not a strong flier, but on account of its habit of remaining on the ground and running to the edge when a net is thrown over it, it often escapes. The larval holes are common here in company with those of *Cicindela lengi* (*venusta*). The latter, however, prefer rather more open situations, as does also the adult.

It is bordering the habitat of *C. lecontei* but nearer the drifting sand, that we meet with the finest of all our tiger beetles, a large strong-flying insect which will often travel three hundred feet or more at a stretch. This is *C. manitoba* Leng., next to *limbata*, the commonest on the sand. He is a great terror to ants and other small insects, nor does he take amiss medium-sized beetles, in fact there is one, *Disonycha quinquevittata*, a regular pest on a sand-binding willow (*Salix longifolia*), which seems to form a goodly proportion of the tiger's food. The larvæ of *C. manitoba*, while very similar to other species, are quite original in their methods of constructing a burrow. Other species have nearly a straight hole usually at right angles to the surface, but *manitoba* constructs a cup-like pit into which the burrow enters horizontally from one side and then gradually curls downwards to a perpendicular position, The advantage of this is that it forms a regular death trap to the unsuspecting insect which happens to be crawling near. Possibly this simple method of procuring food is at least in part responsible for the larger size of the species.

Returning again to the centre of the sand we encounter a longish valley blown almost down to water and sheltered by sand banks. Here on a hot day, we shall encounter all the tiger beetles already mentioned, as well as *obliquata*, 12-*guttata* and *repanda*. Among the wet sand here are numerous heaps of sand evidently shoved up by an animal burrowing straight downwards. Select a fresh one and dig carefully to five or six inches and you will discover a roundish beetle rather like a large lady-bird beetle superficially, which in reality, however, belongs to the Carabidæ and is *Omophron americanum*.

In the higher spots are the larval holes of another tiger beetle called *C. lepida*. They are right on the drifting sand and one wonders how the insects manage to keep their holes open or procure sufficient food in such a desert. As a matter of fact there is evidence to indicate that such unfavorable conditions have at least lengthened the larval life to a year beyond the average. Should we be lucky enough to discover a mature larval burrow we might, at this time, trace from it that of the pupal chamber which is the longest I have yet come across. The larva when mature

constructs a burrow branching out semi-horizontally from the original one, commencing about two inches below the surface and having an average length of nine inches, though some I examined extended for eleven. The burrows slant downwards to a depth of five inches from the surface at their extremity. Here in an enlarged chamber the pupa develops, and afterwards the beetle. The adult of *C. lepida* appears toward the end of June and is as perfect as can well be in its colour resemblance to the sand. It is a very weak flier, due doubtless to its being far safer on the sand in its deceiving dress than it ever would be in an attempt to escape by flight.

Lepidoptera are not very much in evidence here in June, but there are a few prizes well worth scouting for. Should we venture to the edge near the swamp we should probably see several butterflies not strictly belonging to the sand, such as our old friend *Œneis jutta*, common enough farther in. Returning to the drier sand we may with good luck see a great rarity called *Copablepharon convexipennis*, though I have no records before July. This species is generally at rest on the sand and unless one is very carefully on the lookout—for it is another sand colour mimic—it will have departed almost before we are aware of its presence.

Among the spreading shoots of *Salix longifolia* may be found a sandy-coloured cutworm, probably *Agrotis aurulenta*. Its work is plain enough to see, but it prefers as a resting place the cool moist sand, and may, therefore, be several inches below the surface.

Another moth very rare at this time, but common a month later, is *Pseudotamila awemensis* Dyar, found as yet nowhere else. Its fore-wings, like so many other creatures found here, resembles the sand, but the secondaries are pure black. It may be found throughout July resting on the sand, or more often on the flowers of Skeleton Weed, *Lygodesmia juncea*.

Among Orthoptera various species of grasshoppers are in evidence, chiefly, however as nymphs. *Hippiscus latifasciatus* is common, as elsewhere, but to my eye looking rather paler than its brethren of the prairies, as if there were an attempt to harmonize just a little with the sand. *Hippiscus neglectus* turns up on the edges of our tree islands or upon the borders of the sand in small numbers.

Then there are various species of *Melanoplus*, viz. *atlanis*, *angustipennis*, *packardi*, *scudderi*, and probably one or two others. None as yet, however, have reached the winged state. We shall also observe *Ochrilidea cinerea* and perhaps *Amphitornus bicolor* in the more grassy spots. But, the most interesting of all and the only species that can in any way be called indigenous to sand is *Trimerotropis agrestis*. It is present over the whole area in various stages of development, but what makes it particularly interesting is its close resemblance in colour to the sand. It seems to have an instinctive knowledge of its protective colouration, and as a result individuals will be found quite motionless often partly buried. The advantage of such protection is, of course, obvious. On a bare area such as it inhabits, contrasting colours would at once attract the attention of birds, such as crows, robins and others, found in the vicinity, but with a dress matched so perfectly detection is reduced to a minimum.

Of bees and wasps there are numbers, a rich collecting ground for a student of the Hymenoptera never as yet worked over. Among the curiosities to a novice are numbers of large semi-cylindrical cocoons originally buried, but often exposed by the winds having shifted the sand. They belong to a large clumsy predaceous wasp (*Bembex pruinosa*), which late in the season becomes a perfect nuisance, buzzing noisily around one's person after flies. To those who do not know they prove quite a terror and I have seen some interesting movements due to fear of being stung. As a matter of fact, however, they appear to be exceedingly harmless, and I have never observed them sting anything larger than a fly, which they use as food for their larvæ.

We shall also meet with numerous true flies (Diptera) though the majority of them are not indigenous to the sand but have been reared in the bog close by—tabanids are there in thousands and it is hardly safe at times to take horses into the vicinity. They do not particularly trouble mankind, however, and on the sand, males are often more plentiful than females, indeed they can be seen hovering in every sunny glade but dart away like a flash when disturbed.

A few flies, however, make their homes here. One, a very pretty Bee-fly, probably belonging to the genus *Exoprosopa*, I

caught some years ago, just emerging from a spot where I had previously marked a *Cicindela* burrow, and as the latter was no longer present I suspect the fly of having been the cause, particularly as Prof. V. E. Shelford records an allied genus as preying upon the larvæ of tiger beetles. Several other species are known to be parasitic, and one has the distinction of destroying locust eggs.

Lastly, as part of the fauna, there is a very beautiful spider (*Geolycosa*) which burrows large holes in the sand, as winter approaches going down five or six feet, but at this time they are comparatively shallow and the females are often but a few inches down with a host of young clinging to their backs. When disturbed with a straw they bite it savagely, and can bite hard too, but curiously enough they have a mortal dread of the various black wasps found later on, which usually paralyze and make use of them for food. I have seen the spiders make frantic efforts to escape from a wasp half their size and eventually when escape was impossible, turn over on their backs and fight, but they fought in despair with the knowledge of almost certain death awaiting them, and thus it always ended. The wasp while keeping at a safe distance was eventually able to use her sting, and soon after was dragging the spider to her burrow.

CATERPILLARS AS WEATHER PROPHETS.

In a Toronto newspaper there recently appeared an article taken from the "New York American," in which a forecast is given of the weather during the approaching winter, stating that "after the most intense cold weather we have experienced for years we shall have a mild spell and great thaws and floods; we shall have a very late and backward spring, with real winter at the time we should have fine spring-like weather. The caterpillar shows light in front, followed with a very well-defined spot of considerable size, and this dark indicates our mid-winter snap. Then the light appears again, and this indicated the warm spell, and if there was no more dark there would be a prospect of a very early spring, but another dark spot appears toward the rear of the caterpillar, and this will bring the late and unseasonable cold at a time we should have our mild weather."

Further on it is stated that "corn husks and the chaff of grain were heavier this season than common, and weed seeds are obtained in heavier coverings than are usually noticed. Larvæ of insects are deeper in the earth. Field mice and other burrowing animals are going deeper, and bark of new wood is much thicker, and weeds are thicker where roots will need protection. All these indicate severe freezing."

The prophet does not tell us what caterpillar he found, but if he had met with a banded larva of the Milkweed Butterfly (*Danaida plexippus*), he might have foretold the whole year of uniform variations during each month, as shown by the stripes on each segment. This is the first time that predictions have been based, so far as we know, upon the markings of caterpillars.

C. J. S. B.

BOOK REVIEW.

THE GENITALIA OF THE BRITISH GEOMETRIDÆ. By F. N. Pierce, F.E.S., The Elms, Dingle, Liverpool, Eng., 1914. Clothbound, price 10/-.

This is a companion volume to the work on the "Genitalia of the British Noctuidæ" published by Mr. Pierce in 1909 and it is gratifying to learn that the reception accorded it was so encouraging that not only is the volume on the Geometers before us, but the author promises that an account of the Genitalia of the Tortricidæ will follow at an early date.

The superficial resemblances that exist between many species of the Geometridæ of Europe and those of North America and especially of Canada have led to endless muddles in our lists, some collectors and authors considering them identical while others are equally certain that they are not. Having now such excellent drawings and descriptions of these structural details of practically every one of the British species, made not from one slide of each but from five or six up to over twenty specimens, and checked and rechecked by the author and his friend, the Rev. C. R. N. Burrows, F.E.S., we should be able to determine whether in our related N.A. species these structures show positively that they are distinct or that they are the same species.

Turning to the book, the introduction gives the names and descriptions of the various parts, a few of which have been altered from those used in the *Noctuidæ*, so as to adopt names which had the right of priority of usage and it is to be hoped that no further changing will be necessary.

This is followed by a classification of the British species based on the male and female genitalia, comprising 78 pages. The family is divided into two primary divisions, designated as *Gnathoi* and *Agnathoi*, according to whether the gnathos is present or absent. The former comprises ten and the latter fifteen subfamilies, producing an arrangement quite unfamiliar and which will no doubt give food for thought and pen to those who hold that no classification should be based on one set of characters only.

The figures of the male organs are given on 48 plates—the name of the species being printed below each drawing—a decided improvement on having numbers and a key somewhere else. In many cases the female genitalia are figured to the left of the male.

The book and its illustrations, showing not only the diversity but also the wonderful beauty of these structures as exhibited in one single family, cannot help being of the greatest interest to Lepidopterists and I am sure that the author will gladly extend to any of our readers the privilege offered the writer in a recent letter, namely to give his assistance in forming opinions on the connections of certain species or genera.

A. F. Winn.

We would remind our readers that subscriptions are now due, and that these and all other business matters connected with the Society or Magazine, such as advertisements, requests for back numbers, etc., should be addressed, *not to the Editor*, but to

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FURTHER NOTES ON ALBERTA LEPIDOPTERA, WITH DESCRIPTION OF A NEW SPECIES.

BY F. H. WOLLEY DOD, MIDNAPORE, ALTA.

(Continued from page 8.)

620. **Agrotis bollii** Grt.?—One female at light, September 3rd, 1904. This is the specimen mentioned by me in Can. Ent., XXXVII, p. 58, Feb., 1905, as "darker and less clearly marked" than *Euxoa mollis*, from which I can easily distinguish it now that I know the latter species better. Grote described the species as *Agrotis hilaris* from a Texas male, which is in the British Museum, but he afterwards found the name preoccupied in the genus in Europe, and substituted *bollii*. Sir George Hampson, however, placing the European and North American *hilaris* in different genera, restores the prior name, which Grote never altered on the type label. The type has a black collar, which my specimen has not, and lacks a dark brown costal mark near the apex possessed by mine, which is also less grey and has the orbicular of different shape. There were no other specimens in the British Museum. A female from Huachuca Mountains, Ariz., in Smith's collection, I think the only one he had standing as *bollii*, appeared more like mine, and also lacked the black collar.

621. **Noctua acarnea** Smith.—(Journ. N. Y. Ent. Soc. XIII, 194, Dec., 1905).

Described from a single male taken by Mr. Sanson at the Banff Museum on July 11th, 1902. I examined the specimen in Smith's collection in January, 1910, and took very careful notes thereon, as it appeared quite distinct from anything I had previously seen. Nor could I, until just before writing the present article, discover anything which might be it amongst the material sent me for naming from time to time by Mr. Sanson. But by good fortune I have before me at this moment a male in good condition taken by him on an electric light pole on July 4th, 1914, and submitted to me just in time for recording here.

It fits Smith's description and my notes exactly, with the exception that I should not call the discoidal spots in the recent capture "large," and the space between them is scarcely darker than the ground. The expanse is 36 mm., a trifle smaller than the size given of the type. It would never have occurred to me to associate the species with *bicarnea* at all. In type of maculation it comes much nearer to *dislocata* Sm., but the colour differs entirely, being very even "dark, almost blackish brown, with a purplish tinge," except for bright, pale carneous patagia, and a carneous shade in and round the reniform. The apparent purplish tinge is probably really due to slight iridescence. All the tibiæ are spined, the fore tibiæ on the inner side only, as is often the case with *dislocata* and *calgary*. I was unable, however, to discover any spines on the fore tibiæ of the type, but noted that they were not in a position easy for examination. The antennæ are minutely ciliate, and in the recent capture at any rate, rather heavily scaled as well. The eyes are without lashes. The head and thorax are thickly clothed with rough hair only, without crests. The wing form and general build is like *dislocata*, in which the antennal structure is similar except that *dislocata* has fewer scales, and rather longer ciliations. The thoracic vestiture is rather rougher than in *dislocata*. As far as these characters go, it seems referable to *Episilia* Hbn., which is used by Hampson as prior to *Pachnobia* Gn. and *Choephora* Grt. It appears to me that both *calgary* and *dislocata*, if not some others which Hampson refers to *Agrotis*, fit better with *Episilia*, as both have loose hairy vestiture without obvious crests. But *acarnea* has one structural peculiarity not hitherto observed in any North American genus referred to the Agrotids except *Trichorthosia*, to which this is quite distantly related. The eyes are sparsely and finely hairy. I mentioned this to Prof. Smith after examining the type, but he was unable to find the hairs and told me that I was mistaken. If I had not been very sure of my point, however, I should not have taken a note on the fact, and on examining the eyes of the recent capture I find the same. The hairs are not easily noticeable, I admit, and anyone might be excused for overlooking them. They are most easily seen in strong sunlight. They are not much easier to find in some specimens of *Perigea alfkenii*, though they are finer in *acarnea*

than in that species. The apparent general relationship to *dislocata* and *calgary* led me to expect to find that these might have hairy eyes, but an examination of a considerable number of specimens has failed to reveal any.

622. **N. bairdii** Smith.—(Journ. N. Y. Ent. Soc. XVI, 84, June, 1908). Described from a single female taken at High River by Mr. Thomas Baird. I saw and took notes on it before Fletcher recognized it in Mr. Baird's collection as something strange and sent it to Smith. Smith says after the description: "There is no very near ally to this species. It belongs obviously to the *lubricans* series, and stands next *atricincta*, than which it is much larger, quite different in ground colour and without the obvious transverse lines. So far as they go, however, the lines in *bairdii* correspond in position with those of *atricincta*." I saw the specimen for the second time at Rutgers College, and noted that it was "rather like a large *digna*. Possibly an ally of *exuberans*. Certainly not *atricincta*." I have certainly never met with another specimen in Alberta that could be this species.

623. **N. vocalis** Grt.?—Banff, July 30th, 1910. N. B. Sanson. In 41st Rept. Ent. Soc. Ont. for 1910 (page 10 of the "Record") I erroneously recorded this specimen as *vernilis*. I corrected the error in Ent. News, XXIV, 361, Oct., 1913, and on page 360 I followed Dr. Dyar in citing *planifrons* and *congrua* as synonyms. From my notes I judge my No. 623 to have been *vocalis*, though I cannot be quite sure of it until I see the specimen again. It was most certainly not *vernilis*. (q. v. No. 618).

624. **Chorizagrotis boretha** Smith*.—(Journ. N.Y. Ent. Soc., XVI, 86, June, 1908). Described from three males and a female from Kaslo, B. C. I have seen a male and female type in the Rutger's College collection. A note after Smith's description states that it is allied to *terrealis*, and in a general way resembles *perexcellens*. I believe that the supposed relationship to *terrealis* was based on an erroneous identification of that species, and failed to notice any resemblance to *perexcellens*. I have two perfect females taken on my place here on Pine Creek, on Aug. 16th, 1901, and Aug. 27th, 1905, exactly alike, and beyond all doubt one species, which I have never yet succeeded in closely associating

*Breeding results have now shown that Nos. 225 and 244 of this list are one species, *sordida* Smith, and in all probability forms of *boretha*.

with anything else listed by me in this series of papers. One of these I have compared with the types of *boretha* and labelled it "Like female type but greyer." On this comparison I base the present record, but it may be as well to remark that my notes state that "The male type is almost like some *ochrogaster*." Whereas my two females bear not the slightest resemblance to any *ochrogaster* that I ever saw, my note seems to suggest that either the range of variation in *boretha* is very wide, or that the female type is not really the same species as the male.

The same Pine Creek female I also compared with the unique female type—lacking abdomen—of *Porosagrotis thanatologia* Dyar, from Kaslo, which I found in the Washington collection. (Proc. U. S. Nat. Mus., XXVII, p. 833, 1914—"Kootenai List"). I noted that it was probably the same species, but my specimen did not match it sufficiently closely to justify making a positive reference.

625. **Rhizagrotis querula** sp. nov.—Head, collar, thorax, and primaries uniform pale fuscous brown, faintly olivaceous, sparsely irrorate with darker scales, but without any streakiness or contrast in shades. *Lagena*, to which the new species is closely allied, has the inferior portion of the collar paler than any other part of the insect, and the upper portion contrastingly dark brown, these two shades being divided by a black line, absent in *querula*. *Lagena*, in all its observed variations is longitudinally streaky, the most conspicuous streaks consisting of long, inwardly dentate or sagittate dark brown marks on the termen, which contrast with the intervening pale streaks bordering the dark veins, especially on 1, 3, 4, and 7. In *querula*, though there is a faint indication of a series of dark subterminal shades in the interspaces, most evident in the male type, but entirely lacking in the female, the actual terminal space is in all six specimens very slightly paler than that immediately preceding it. In *querula* the conjoined discoidal spots, though outlined by a pale shade and partially defined by black scales, have not the whitish annuli of *lagena*, and unlike those of that species, are not contrasted by a darkening of the cell before and below them. A fine black basal streak is present in all but one, and all show indications of dark t. p. lines, produced to points on the veins, and in two of the males they are well marked, continuous, some specimens showing a faint t. a. line as well. But

these are occasionally discernible in *lagena*. In *querula* the secondaries of both sexes are slightly dull, and in the male lack the clear whiteness of those of *lagena*. Antennæ and all superficial structural characters, as in *lagena*. Expanse: Male 38–44 mm.; female 46 mm. (equalling *lagena* in size).

Described from five males and one female from the Red Deer River, about 50 miles to the north east of Gleichen, Alta. July 1st and 3rd, 1905; and July 23rd and 24th, 1907. All but one in good condition. Taken by Mr. A. F. Hudson and the author at dusk at snowberry flowers, and at treacle.

Types.—♂ in the collection of the author, ♀ in that of Dr. Wm. Barnes. I have made three of the remaining four males co-types.

This is the species which I recorded under the name *lagena* in 37th Rept. Ent. Soc. Ont. for 1906, p. 94, 1907, and 38th Rept., p. 121, 1908 (page 9 of the "Record" for 1907). It is possible that it may turn out to be merely a variety of that species, though I have nothing suggesting an intergrade, and have no record of *lagena* from Canada. The type of *lagena* is a female from Nevada, and is figured by Hampson. I have compared it with one of my Utah specimens, of which I have a long series. I have it also from Colorado, New Mexico, and Arizona, and it is recorded from Montana.

626. **Feltia volubilis** Harv.—I have three males and a female which I took at the Chalet lights, Laggan, on July 17th and 18th, 1907, and Mr. Sanson took a male at Banff on about June 24th, 1914. One of the males I have compared with the male type from New York in the British Museum, and found it a very close match. It is of the dark red-brown form figured by Hampson, but differs from all my eastern specimens of that form in having the secondaries uniformly dark. I have one Washington and one Oregon specimen with secondaries pale as in the eastern form. On the other hand, all my eastern examples of the paler and greyer *stigmosa* have uniform dark secondaries in both sexes. Holland's Plate XXII, fig. 23, is of this latter form. The two forms appear to be now universally accepted as one species, though I can find no record that both have ever been bred from one. Specimens from some localities certainly appear about intermediate. For instance, I

have Manitoba males which belong to neither extreme, but have the centrally pale subhyaline secondaries of typical *volubilis*.

I have a Kaslo male exactly like those from Laggan. Other Kaslo specimens have vinous red shades contrasting with a pale, sometimes almost violaceous grey ground, like typical *vancouverensis* from Vancouver Island. But study of a long Kaslo series has left me in serious doubt as to whether *vancouverensis* and *volubilis* are really distinct. A somewhat intermediate form is that named *semiclarata* by Grote, of which the type is from Washington Territory. I have compared a Kaslo male with it, and found it to match exactly. A Corvallis, Oregon specimen, perhaps a trifle nearer to typical *vancouverensis* than is *semiclarata*, I have compared with Strecker's three female types of *atha* from Seattle, Washington, and believe it to be the same.

As a rule a good point of distinction between *vancouverensis* and *volubilis* is in the subterminal line. In the former this is more or less distinct, crenulate, with a fairly well marked and not very deep W. In *volubilis* it is often lacking, or when faintly indicated is sharply dentate, with a W reaching clear to the margin. But this character does not always hold, and where colour characters fail, as is so often the case in the material from the mountain districts inland, a positive reference to either *vancouverensis* or *volubilis* is not always possible. Dr. Dyar apparently met with this difficulty when, in the Kootenai List, after recording the capture of seventy-five specimens of *vancouverensis*, he follows them up with only one of *volubilis*, adding: "This seems to me only an extreme form of *vancouverensis*." (Proc. U. S. Nat. Mus., XXVII, p. 832, 1904). I should add that I have examined other Kaslo material of this group besides that in my own collection.

627. **Porosagrotis orthogonia** Morr. var. **delorata** Smith. The North-western Canadian form of *orthogonia* was described as a species as *delorata* by Smith in Journ. N. Y. Ent. Soc., XVI, p. 87, June, 1908, from a single male taken at High River by Mr. Baird. Mrs. Nicholl had taken a male which stands in the British Museum collection labelled "B. C. prairie 1. IX. 07," though the specimen is recorded by Sir George Hampson, under *orthogonia*, in Can. Ent. XL, p. 102, March, 1908, as from "Alberta prairie." From the date, and knowledge of Mrs. Nicholl's movements, I should judge

Alberta to be its most probable origin. I had for some years previously had a couple of specimens in my collection from Regina, Assa. In the spring of 1911 "cutworm" larvæ were reported as doing very serious damage to fodder and field crops in Southern Alberta, round Lethbridge, Monarch, etc. (42nd Rept. Ent. Soc. Ont. for 1911, p. 94 [p. 6 of the "Record"]—1912). Larvæ sent to the Experimental Farm at Ottawa produced specimens of *delorata* on Aug. 14th and 20th of the same year, the specimens being sent to me for determination. I received a couple more males from Mr. Baird labelled High River, Sept. 1st, 1911, and have seen two pairs taken by Mr. J. B. Wallis at Lethbridge on Aug. 23rd to 26th, 1912. *Orthogonia* was described from Glencoe, Nebraska. I have specimens from Colorado, and a very large number from Utah. The few Canadian specimens I have seen have all been more uniformly dark olivaceous in tone than is usual with southern examples, and have wholly dark secondaries. Morrison's type, which I have not seen, had the "markings well expressed," and secondaries whitish inwardly. Pale secondaries are usual in my southern series, but some have them very nearly as dark as Canadian specimens, and differ scarcely if at all as to primaries. In short, comparing Alberta specimens with some of my darkest from Colorado and Utah, there is really no difference worthy of remark. I should never have considered the darkest forms to be worthy of a varietal name, but as one has been named, let *delorata* stand for a dark olivaceous variation of *orthogonia* without pale shades and with wholly dark secondaries in the male. I have previously explained that the *orthogonia* recorded by me with a query as No. 236 in my original notes (Can. Ent., XXXVII, p. 53, Feb. 1905) was a different species. I now believe that specimen to have been a badly worn and bleached *ridingsiana*.

628. **Euxoa rabiata** Smith.—(Trans. Am. Ent. Soc., XXXVI, p. 255, Nov., 1910). Described from six males and two females from Volga, South Dakota; Colorado; and Calgary, one of the females being from the latter place, and dated Aug. 29th. I happen to have taken some notes on a group of specimens standing separated in Smith's collection, from which, or from a selection of which the description referred to was subsequently made. Judging from these notes in conjunction with the description, I think it very

probable that the name refers to *dargo* Strecker (No. 237 of this list), or to a mixture of that and *niveilinea*. The latter species I have never taken.

629. **E. dolens** Smith.—(Can.Ent., XXXVIII, p.226, *Setagrotis*, July, 1906); syn. *quinta* Smith (Ann. N. Y. Acad. Sci., XVIII, p. 97, *Euxoa*, Jan., 1908). *Dolens* was described from a male and two females from Beulah, Man., and Arrowhead Lake, B. C. I saw a pair of types in Smith's collection, the male from Beulah, and the female from Arrowhead Lake. *Quinta* was described from three males and two females from High River (Baird), and Kaslo (Cockle), and I have seen a type from the former locality in Smith's collection. I made the reference in my notes after direct comparison of the types, and Smith admitted its correctness to me personally. It is a close ally of and agrees structurally with *scandens* Riley, which Hampson places in *Lycophotia* Hbn. Both species lack the tuberculate frons of *Euxoa*. Compared with *scandens* the newer species is darker, has more distinct t. a. and t. p. lines, and uniform dark secondaries. I have a defective male from High River, dated September 7th, 1908. The dates given under the description of *dolens* are Arrowhead Lake, June 8-15, and Beulah, Aug. 28th. Under *quinta*, Kaslo, June 1st, 30th, and July 7th and 10th. No dates to the High River types.

Quebecensis was described from a single female from Quebec, and referred doubtfully to *Setagrotis*. I have seen the type in the Washington Museum, and though I had nothing with which to compare it, I believe that this will be found to be a prior name to *dolens*.

630. **E. septentrionalis** Walk.—A male at Lethbridge on Aug. 21st, 1912, by Mr. Wallis. This is the only example taken in Alberta that I have seen, which I have been quite certain was this species, and all the records I have seen under the name from other places in Canada east of the Rockies have proved erroneous upon investigation. It is a species sometimes very closely resembling *messoria*, so closely in fact as to make separation very difficult, but it is undoubtedly distinct, as listed by Hampson, who correctly makes *incubita* Smith a synonym. It is sometimes very common on Vancouver Island. Another very closely resembling, though smaller species, is *pestula* Smith. (My Nos. 249 and 265).

[631. **E. rufula** Smith.—In Prof. Smith's collection I found a specimen marked "*rufula* Smith Xd type," and bearing label "Ft. Calgary, N. W. B. C." Smith told me, however, that the accuracy of the label was doubtful. That is to say, that it is doubtful whether the specimen was really taken at Calgary, which, though formerly a fort, was never in B. C. *Rufula* is not a synonym of *infausta* as listed by both Smith and Hampson, but is the species figured by Hampson, I think erroneously, as *basiflava*.]

632. **E. compressipennis** Smith.—A female taken at Banff, at light, on Aug. 19th, 1909. In 41st Rept. Ent. Soc. Ont. for 1910 (page 11 of the "Record"), 1911, I recorded the specimen as *basiflava*, and an added note says: "This was described from N. W. B. C. *Compressipennis* was described from Yosemite, B. C. The types are identical." That note unfortunately contains two inaccuracies. *Compressipennis* was described from Yosemite, California, which I feel convinced was the statement that I sent into print. But "the types are identical" was my own unguarded statement. What I should have said was that the male type of *compressipennis* in the Washington Museum was absolutely identical with the female type of *basiflava* in the same collection. The latter was described from "North West British Columbia" (possibly meaning the Alberta Rockies—who can tell?), I think from a single pair only. I had previously seen the male type also in the Neumoegen collection in the Brooklyn Museum, and do not feel confident that it is the same species, and must therefore modify my positive reference until I can positively identify the male type.

633. **E. obeliscoides** Gn. and var. *infusa* Smith.—*Infusa* was described as a species from two males, from Cartwright, Man., and Black Hills, Wyo. The Cartwright specimen is the type in the Washington Museum. The other I have not seen. A note after the description adds: "The species is really *obeliscoides* without the contrasting costa, and with the t. p. line lost so that there is an almost even shade below the cell from t. a. line to outer margin; the terminal space being scarcely deeper. The ground colour and general variation in tint are as in *obeliscoides*, but the species is perceptibly smaller."

Obeliscoides is not rare at Cartwright, and most specimens that I have seen from there entirely lack the red-brown shades of

Guenée's type and of Grote's *sexatilis*. I have no note as to whether the type of *infusa* lacks them, and they occasionally exist in Manitoba specimens, but it was not on their absence that the supposed species was based. The costa is not usually very contrasting and occasionally the t. p. line is very indistinct, so I suppose Smith's name should stand for a rather small form possessing these characters, which are not characteristic of the prairie race as a whole.

I have a female taken here on September 2nd, 1907, to which the varietal name seems applicable, and have seen a male of the species taken at Lethbridge by Mr. Wallis on August 8th, 1912.

It is practically impossible to distinguish some Manitoba females from some of that sex of British *obelisca* Hbn. in my possession, though North American males appear to have finer antennal serrations than males of *obelisca*.

634. **E. colata** Grt.—I saw a male in Smith's collection labelled "Laggan, 6,800 ft.," presumably from Bean. A male taken by Mrs. Nicholl at 8,000 ft. on Wilcox Peak is in the British Museum, and is evidently the same species as the female type there from Mt. Hood, Oregon. A third male, in splendid condition, was taken by Mr. Sanson on the summit of Sulphur Mt., Banff, about 7,200 ft. The species appears to be more closely allied to *mollis* than to *divergens*, with which Grote associated it.

(To be continued.)

SOME CHALCIDOID HYMENOPTERA FROM NORTH QUEENSLAND.

BY A. A. GIRAULT, NELSON (CAIRNS), AUSTRALIA.

(Continued from page 20.)

Family ELASMIDÆ.

Genus *Elasmus* Westwood.

1. **Elasmus margiscutellum,** n. sp.

Female.—Length 1.70 mm.

Dark metallic green, the distal margins of mesopostscutellum and the scutellum margined with lemon yellow. Sides of thorax and legs black, the tegulæ, knees, tarsi and distal half or less of intermediate and cephalic femora pale yellowish white, the antennæ

brownish. Abdomen with base concolorous transversely and also the distal fourth, the rather long intervening portion orange yellow marked along each side (from both dorsal and ventral aspects) with a longitudinal row of from 3 to 4 black dots. Wings subhyaline. Mandibles with eleven teeth, the first two large, the others minute. First ring-joint very short. First funicle joint longer than the pedicel, the distal one only slightly longer than the pedicel but longer than any of the club joints.

Male.—Not known.

Described from one female captured by sweeping the forest growths on Mount Pyramid (1500—2500 feet), June 2, 1913 (A. P. Dodd).

Habitat.—Australia—Nelson (Cairns), Queensland.

Type.—The above female on a tag and a slide with the head.

2. **Elasmus orientalis,** n. sp.

Female.—Length 1.57 mm.

Like *pallidicornis* Girault, but the antennal concolorous with the body, the scape (except slightly above) pale brown and the cephalic tibiæ are white; also the knees. Moreover, the funicle joints are subequal, all distinctly longer than wide and each a little longer than the pedicel.

Male.—Not known.

Described from one female captured by sweeping in a jungle, May 18, 1913 (A. P. Dodd).

Habitat.—Australia—Kuranda, Queensland.

Type.—The above specimen on a card or tag.

Family CHALCIDIDÆ.

CHALCITELLINI.

Genus *Chalcitelloides* Girault.

1. **Chalcitelloides nigrithorax,** n. sp.

Female.—Length 2.60 mm.

Black but like the type species (*nigriscutum*) except that only the scape, pedicel and first four funicle joints are red; abdomen blood red, but black above and along upper half of each side (a little proximad of middle), the petiole black; tegulæ and legs (except coxæ) blood red, the hind femur with a long rounded black spot centrally. Antennæ 11-jointed. Fore wings lightly stained.

Funicle joints after the first wider than long, the rather indistinctly sutured first club joint shorter than the other joint of that part; joints of funicle widening distad, the flagellum clavate. Punctures of thorax not densely confluent, separated. (Median carina of propodeum not seen distinctly).

Male.—Not known.

Described from one female captured from a window, November 4, 1912.

Habitat.—Australia—Proserpine, Queensland.

Type.—The above specimen on a tag and a slide bearing the head, a fore and a hind leg.

The antennæ of this genus were originally described as being 10-jointed, but a re-examination of the type, shows that its club is 2-jointed, the black portion being the distal or second joint.

Family AGAONIDÆ.

Genus *Agaon* Dalmar.

1. **Agaon nigriventre,** n. sp.

Female.—Length 2.20 mm., excluding ovipositor, which is exserted for a length about equal to that of the abdomen.

Orange yellow, the posterior margin of the head, flagellum, all of the abdomen except at base, an hour-glass shaped marking down meson of pronotum and cephalic part of scutum (a smaller end cephalad; shaped like an inverted egg-cup), a stripe across apex of thorax (about apex of scutellum), the tegulæ and a dot in a line longitudinally with them, cephalad (opposite the apex of the egg-cup-shaped marking) jet black; also the valves of the ovipositor. Agreeing with all the characters of the genus as given by Ashmead, but the mandibles bidentate at apex (but four teeth or even five in all), the antennæ 9-jointed without a ring-joint, the scape hemispherically dilated (foliaciously). First and second funicle joints subequal, longer, longer than the pedicel, which is subequal to the distal funicle joint. Postmarginal vein longer than either marginal and stigmal, the latter shortest. Wings hyaline. Body glabrous.

Male.—Unknown.

Described from one female received from the South Australian Museum, Adelaide, mounted on a card labelled "A. M. Lea."

Habitat.—Australia—Mount Tambourine, Queensland.

Type.—The above specimen, the head on a slide.

Family PTEROMALIDÆ.

SPHEGIGASTEINI.

Eurydinotomorpha, new genus.

Female.—Closely allied with *Eurydinotella* Girault but the abdomen is long, pointed conic-ovate, the second segment occupying only about a fifth (or slightly more) of the surface, the abdomen longer than the head and thorax united. Postmarginal vein very long, over twice the length of the stigmal. First funicle joint longest, longer than the pedicel. Propodeum with abbreviated median and lateral carinæ. Parapsidal furrows a little over half complete. Second abdominal segment nearly four times the length of the third, the fourth nearly twice the length of the third, subequal to segment 5, segment 6 a little longer than 4 and 5 while 7 is apparently as long as, or longer than, 2. Petiole distinct, but short. Caudal margin of abdominal segments straight. The genus has the habitus of *Sympiesis* of the Eulophidæ.

Male.—Not known.

Type.—The following species.

1. **Eurydinotomorpha pax,** n. sp.

Female.—Length 3.00 mm.

Metallic shining blue, the abdomen æneous green, purple dorsad, the wings hyaline, the venation tarsi, tips of tibiæ and scape pale yellow, the femora and tibiæ reddish brown, the coxæ concolorous. Pedicel and first ring-joint suffused with pallid. First club joint forming over half the club, subequal to the third funicle joint which is a fourth longer than the pedicel. Short white hairs on mesoscutum giving an effect somewhat as is common with species of *Catolaccus*. Head and thorax reticulated, the propodeum more densely so, the network smaller, the abdomen finely so. Funicle and club black.

Male.—Unknown.

Described from one female captured by sweeping in jungle, October 28, 1911.

Habitat.—Australia—Babinda (near Cairns), N. Queensland.

Type.—The above specimen on a tag and a slide with hind legs and the head.

Family MISCOGASTERIDÆ.

PIRENINÆ.

Erotolepsiella, new genus.

Female.—Running to *Erotolepsia* Howard, but the stigmal and postmarginal veins extremely long, subequal, each over three-fourths the length of the marginal, the antennal pedicel somewhat shorter than the solid club, the eyes naked or nearly so. There is a single ring-joint and the first funicle joint is subquadrate and narrower than the others, the second and third joints longest. Fore wings banded. Cephalic femur somewhat swollen, but simple. Mandibles tridentate. Parapsidal furrows complete, delicate. Abdomen pointed conic-ovate, the second segment longest but occupying only about a third of the surface, its caudal margin entire. Propodeum with a neck but with no carinæ, rugose, the scutellum with a not very distinct cross-furrow before apex. Abdomen with a short, stout petiole. Antennæ 11-jointed. With the habitus of the Pteromalidæ.

Male.—Unknown.

Type.—The following species.

1. **Erotolepsiella bifasciata,** n. sp.

Female.—Length 1.80 mm.

Purplish brown, the tip of the abdomen ringed narrowly with white, the distal part of metathorax and the short abdominal petiole also white. Legs concolorous, the tarsi yellowish white, the antennæ concolorous. Fore wings with two conspicuous black-brown bands across them, the first narrow and from the bend of the submarginal vein, the second very broad and from the stigmal vein. Thorax punctate.

Male.—Not known.

Described from a single female captured by sweeping in jungle, October 28, 1911.

Habitat.—Australia—Babinda, North Queensland.

Type.—The above specimen on a tag and a slide with the head and posterior tibia.

Family CALLIMOMIDÆ.

MEGASTIGMINÆ.

Genus *Neomegastigmus* Girault.

1. **Neomegastigmus collaris,** n. sp.

Female.— Length 1.35 mm., excluding the ovipositor, which is about equal to the abdomen in length.

Like *lividus*, but the ovipositor is shorter and the pronotum pale orange yellow; also the legs are whiter, not pale lemon yellow. The scutellum is uniformly sculptured in both species, like the rest of the mesonotum. Also the head is dark orange yellow. Abdomen subsessile.

Male.—Not known.

Described from a single female captured by sweeping in open forest (grasses), March 11, 1912.

Habitat.—Australia—Thursday Island, Torres Strait.

Type.—The above specimen on a tag, the head on a slide.

2. **Neomegastigmus petiolatus,** n. sp.

Female.—Length 1.95 mm., excluding the black exserted valves of the ovipositor, which are about two-thirds the length of the abdomen.

Orange yellow, the abdomen (its short, distinct petiole pallid), propodeum and distal third of scutellum purplish black. Fuscous spot from stigma large, nearly a band across the wing. Caudal margin of segments 2–4 of abdomen incised at meson, the incision large, wide on segment 2, minute on segment 4. Cephalic legs (femur and distad) pale the others concolorous with the abdomen, but all tarsi pale, the antennæ straw yellow; funicle joints all shorter than the pedicel. Thorax densely reticulated and transversely lineolated.

Male.—Not known.

Described from one female captured by sweeping lantana and other bushes in a field near town, October 21, 1911.

Habitat.—Australia—Mackay, Queensland.

Type.—The above specimen on a tag and a slide bearing the head.

3. **Neomegastigmus lividus** Girault.

One female by sweeping lantana and other bushes in a meadow near the town of Mackay, Queensland, October 21, 1911.

IDARNINÆ.

Genus *Philotrypesis* Foerster.

1. **Philotrypesis longiventris,** n. sp.

Female.— Length 2.75 mm., exclusive of the ovipositor. Brownish black, the legs including the coxæ yellowish brown, the wings hyaline; sides and venter of abdomen yellowish brown. Scape concolorous with the legs, the flagellum black, the black pedicel subequal to the first funicle joint, the next two (joints 2 and 3) funicle joints subequal, each a little shorter than 1; distal funicle joint a little longer than each of the three club joints. Clypeal area yellow. Mandibles bidentate. Body, including propodeum and abdomen, finely scaly, the propodeum without a median carina.

Male.—Unknown.

Described from one female captured by sweeping in a jungle pocket, June 4, 1913.

Habitat.—Australia—Nelson (Cairns), Queensland.

Type.—The above specimen on a tag, the head on a slide.

Genus *Sycoscaptella* Westwood.

1. **Sycoscaptella angela,** n. sp.

Female.—Length 2.26 mm., excluding the black ovipositor, which is nearly as long as the body.

Deep pinkish orange, the wings hyaline, the legs and scape concolorous, the flagellum dusky. Three transverse black spots across meson of abdomen, the first smallest, all more or less triangular; also a black dot at meson, apex of fifth segment and which is nearly joined to the narrow black dorsal surface of the (following) two produced or tubular segments of which the second is shorter. Postmarginal vein longer than the stigmal. Propodeum with three delicate sulci at meson, separate, the scutellum simple, but both it and the scutum with a median longitudinal impression. Thorax finely reticulated. Antennæ 13-jointed, three ring and club joints, the funicle joints only slightly longer than wide and more or less equal. Mandibles bidentate.

Male.—Unknown.

Described from one female captured by sweeping in forest, November 6, 1912.

Habitat.—Australia—Ayr, Queensland.

Type.—The above specimen on a tag and a slide with the head.

NOTES FROM OTTAWA.

Mr. H. F. Hudson, Field Officer of the Entomological Branch, in charge of the Entomological Laboratory at Strathroy, Ont., has given up his Entomological work and has joined the First Battery of the Canadian Field Artillery of the Second Contingent which is expected to leave for England for service abroad early in 1915. He is now in training with his company at London, Ont. The good wishes of his many Entomological friends will go with him.

Mr. J. B. Gareau has been appointed a Field Officer and Inspector of the Entomological Branch and commences his duties on January 1st. Mr. Gareau is a graduate of the Quebec Forestry School and during the last two years has been an officer of the Forest Service of British Columbia. He has also studied under Prof. Kellogg at Stanford University, California from which institution he was appointed. Mr. Gareau will continue the work formerly carried on by Mr. Hudson.

POPULAR AND ECONOMIC ENTOMOLOGY.

DEFORMED APPLES AND THE CAUSES.

BY L. CAESAR, GUELPH, ONT.

It is a very common occurrence in almost every district to find apples that are so deformed that they have to be rejected as culls. Neglected orchards have usually, as one would expect, the greater proportion of such fruit; there are, however, exceptions where the best cared-for orchards suffer severely. Although most of the causes of these deformities have now been discovered there are still some cases that have not yet been solved.

Insect Injuries as a Cause.

The chief insects to which malformed apples may be attributed are Plum Curculio, Apple Curculio, Leaf-bugs or Capsids, Aphids, Apple Maggot or Railroad Worm, Leaf-rollers and Green Fruit-worms. Each of these will now be discussed in turn.

Plum Curculio. Many apples and pears are deformed as a result of the egg-laying and early feeding habits of this small snout-beetle. The injury in such cases is done while the fruit is still small. The eggs in these apples or pears either fail to hatch

or the young larvæ die very early, because if they live, the fruit almost always falls prematurely. The malformation is due to the tissues immediately around the injured area not growing or growing very slowly while the rest of the apple grows at the normal rate; therefore a depression is produced at the affected part. There are often several such depressions in a fruit. There is usually a scar at the point of injury. Uncultivated and neglected orchards and those bordering on woods or thickets or waste places are regularly much worse attacked than well cultivated and sprayed ones.

Apple Curculio. This is also a snout-beetle. It is smaller than the Plum Curculio, and has a longer and more slender snout. With this it eats deep holes into the fruit for feeding and egg-laying purposes. As in the case of the Plum Curculio, apples usually drop early if the larvæ from the eggs hatch and live; otherwise they remain on the tree, but are deformed in the manner shown in the photograph. Note the regular inverted, cone-shaped outline of the depression with the little hole at the apex. This helps in the identification of the injury. Apple Curculios are not very common in most parts of Canada, but there are a few counties in which they do much damage.

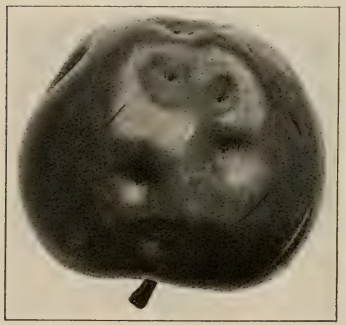

Fig. 1.—The work of the Apple Curculio. Notice the little holes at the bottom of the punctures and the uniform inverted cone type of the depression.

Leaf-Bugs or Capsids. These insects have in recent years been found to be the cause of a large number of deformed apples in the Northern United States and in parts of Canada. At least five species are now known to cause malformed apples, viz., *Hetero-*

cordylus malinus, *Lygidea mendax*, *Neurocolpus nubilus*, *Paracalacoris colon* and *Lygus invitus*. The injuries in each case are made while the fruit is still small and are caused by the nymphs or young bugs making deep punctures into it with their needle-like mouth

Fig. 2.—Work of Capsids or Leaf-bugs on apples. This is done when the apples are very small.

parts. The juice is sucked out through these punctures. Very severely injured apples usually drop off. The remainder hang on but are often much distorted in consequence of the punctures received. The nymphs of the first two species are red and easily seen; those of the others are usually greenish or brownish green colour, and are more likely to escape observation. The addition of a tobacco extract, such as Black-leaf 40, to the regular Codling Moth spray will do much to destroy these insects.

Aphids. Most fruit growers are familiar with the clusters of small woody, more or less deformed apples caused by these sucking insects. Wherever the aphids feed upon a young apple, they leave little depressions or dimples. In many cases these depressions disappear with the growth of the apple. The peculiar tenacity with which a badly infested cluster of fruit hangs on the

Fig. 3.—Cluster of small, woody, deformed apples, caused by the feeding of Aphids on twigs, leaves and fruit.

tree seems to be the result of the small amount of food and sap that the fruit and fruit stems receive in consequence of the feeding of the insects on the leaves and new growth of the branch that bears the cluster. Such partial starvation produces tough tissues in stems and fruit.

Apple Maggot or Railroad Worm.—If the fruit is only slightly infested with this insect it seldom produces any noticeable deformity except the very small depressions where the eggs are laid, but if the infestation is severe almost every apple on the tree may be rendered unsightly by ridges and bulges on the surface. These are partly the result of numerous egg punctures and partly of the death and therefore failure to grow of tissues here and there just beneath the skin wherever the larvæ happened to tunnel when feeding.

Leaf-Rollers and Green Fruit Worms.—These are greenish caterpillars that attack the apples soon after they are formed and frequently eat deep holes in them. As the apples grow these injuries callous over but are often so deep that the fruit is distorted and cannot be marketed. Any other biting insect that eats out similar areas may also cause a deformed fruit.

Other Causes of Deformities.

Although most of the deformities of apples are caused by insects, a number is due to some of the following factors: Frost injury, fungus diseases, imperfect fertilization, Bitter Pit disease or spray injury.

Frost Injury.—Fruit recently set may become partly frozen with the result that the injured area will fail to develop normally and a malformed apple will be produced. It is claimed that frost injury to blossom buds may also cause deformed fruits.

Fungous Diseases. Any fungus disease, such as Apple Scab, which attacks one side of the apple much worse than the other, will by interfering with the growth of that side cause a deformity.

Bitter Pit Disease.—This is a disease of apples due neither to a fungus nor a bacterium, but so far as known to weather conditions. Good growing weather in spring, or early summer followed by drought, seems in Ontario to be the chief cause. Soil conditions and the individuality of the tree are apparently contributing factors. The disease takes various forms; sometimes the apples look quite sound but, when cut open, are found to have dry dead areas here and there through them; at other times, especially in the case of Baldwins, the surface is pitted with

Fig. 4.—Duchess Apple deformed by a very severe attack of Bitter Pit Disease.

small depressed areas that are at first somewhat darker in colour than the rest of the epidermis and later turn brown; in still other cases the injury inside the fruit is so severe that the whole apple becomes much distorted and unfit for use. This last kind of injury is not nearly so common as either of the others.

Imperfect Fertilization.—If during the blossom period one or more of the pistils of the fruit fails to be fertilized the result is often a lop-sided or malformed fruit.

Spray Injury.—Sometimes spray mixtures, especially Bordeaux, injures a portion of the epidermis of a young fruit and, if the injury is sufficiently deep, will cause an interruption in the growth of that side and consequently a deformity. The failure of the surface over these injuries to keep pace with the growth of the tissues beneath often leads to its becoming cracked.

A NEW SPECIES OF THE GENUS NEPHROCERUS.

BY CHARLES W. JOHNSON, BOSTON, MASS.

The determination of the two American species of this genus has presented some difficulties owing to the dearth of material and to their close resemblance to some of the European species. Through the kindness of Mr. Frederick Knab, I have been able to study both sexes of *N. daeckei* and the specimen of the undescribed species collected by Mrs. A. T. Slosson, on Mt. Washington, N. H., in 1897. During the past two seasons six specimens of the latter have been collected, thus giving ample material to define more clearly our two species.

The following table, including the three European species will show some of the structural characters separating them from the American species:—

Table of Species.

1. Last tarsal joints of all the legs without conspicuously long, bristly hairs, arista entirely black.....*lapponica* Zett.

   Last tarsal joints of all the legs with 4–7 long, bristly hairs ... 2

2. Hind tibiæ rather twisted, widened at the end, and with a circle of bristles at the tip.....*flavicornis* Zett.

Hind tibiæ simple, not noticeably widened at the ends, and without a circle of bristles at the tip.....3

3. Arista entirely black, third joint of the antennæ small, brown.....*scutellatus* Macq.

Arista with the thickened basal portion yellow, antennæ entirely bright yellow.....4

4. Abdomen with two distinct bands in both sexes; upper half of front of female linear.....*daeckei* Johns.

Abdomen indistinctly banded in the male, in the female the lateral margins are yellow, upper half of the front of the female not linear.....*slossonæ* sp. n.

Nephrocerus daeckei Johnson.

N. daeckei Johns., Ent. News, Vol. XIV, p. 107, 1903.

In this species the sexes are so similar that one of the co-types before me was inadvertently referred to as a male, probably because the front is so narrow. For about one-half its length it is a mere line. The sides of the first and the posterior margins of the second and third abdominal segments are widely margined with yellow. The wings are proportionately broader and not of equal width as in the following species.

In addition to the types from Richmond Hill, Long Island, N. Y., July 2, 1901, I have examined two males from Plummer's Island, Md., June 29, 1913 (R. E. Shannon), and one female, Franconia, N. H. (Mrs. Slosson) in the U. S. National Museum.

Nephrocerus slossonæ, sp. n.

Nephrocerus, n. sp. Ent. News, Vol. VIII, p. 237, 1897.

Male.—Face and front covered with silvery white tomentum, vertical triangle and occiput black, grayish pruinose, occipital orbits deeply emarginate, mouth parts and antennæ light yellow, arista black, the thickened base light yellow. Thorax, discal portion black, shining, the anterior third covered with a grayish bloom, humeri, broad lateral stripes, and the scutellum, yellow, the latter much darker than the humeri, pleura livid, a lighter

area below the base of the wing bearing a small black spot, metanotum black. Abdomen black, shining, thinly covered with quite long yellow hair, with conspicuous tufts on the sides of the first segment, sides of the first and the posterior margins of the second and third segments brownish, hypopygium brown, the two large rounded glands diverted to the right, with a black, spirally coiled "flagellum" below. Legs and halteres light yellow, the long bristles at the end of the last tarsal joints four in number, posterior tibiæ nearly straight, not noticeably thickened and without bristles. Wings long, narrow, of nearly equal width, grayish hyaline, posterior branch of the fifth longitudinal vein scarcely reaching the margin, tegulæ yellow.

Length 8 mm., wing 9 mm.

Female.—Front narrow below the vertex, gradually widening above the antennæ, about four times its width at the vertex. Thorax similar to that of the male except that the pleura are light yellow with small black point below the base of the wing, and black spots between the coxæ, disc of the scutellum and the metanotum blackish. Abdomen dark yellow, with an irregular, broad dorsal line of black constricted at the margins and covering about one-third of each of the first five segments, the fourth and fifth segments also narrowly margined posteriorly with black, sixth and seventh segments and the hook-like ovipositor entirely yellow.

Length 7.5, wing 8.5 mm.

Five males amd two females. Holotype, allotype and one paratype, Bretton Woods, N. H., June 25 and 28, 1913 (C. W. Johnson), and one paratype (♂), Mt. Washington above Base Station, N. H., July 4, 1914 (C. A. Frost), in the collection of the Boston Society of Natural History. One paratype (♂) summit of Mt. Washington (Mrs. Slosson) in U. S. National Museum. One paratype (♂) Bretton Woods, June 28, in Museum of Comparative Zoology, and one (♂) Mt. Washington above Base Station, July 4, in the author's collection. The specimens collected by Mrs. Slosson and one of those collected by Mr. Frost have the abdomen entirely black.

AN IMPORTED RED SPIDER ATTACKING FRUIT TREES.

BY L. CAESAR, PROVINCIAL ENTOMOLOGIST, GUELPH, ONT.

For some time the writer had suspected that the Red Spider so common on fruit trees in Ontario was not our common species, *Tetranychus bimaculatus*. Accordingly specimens were sent in September, 1912, to Mr. Nathan Banks of the Bureau of Entomology, Washington, D. C., with some details as to the extent of its distribution and the food plants attacked. In reply Mr. Banks stated that the species was *Tetranychus pilosus*, an European species that attacks fruit trees, and that its relationship to *Tetranychus mytilaspidis*, which feeds chiefly on oranges, was very close and, perhaps, identical.

Tetranychus pilosus is about the same size as *bimaculatus*, but differs from it in several respects:—It is more nearly circular in outline, somewhat stouter and has a number of distinct white tubercles on the dorsal surface, with a fine hair arising from each. It is dark red in colour, many specimens being blackish, with the mouth parts and usually a dorsal longitudinal area much paler than the rest of the upper surface, whereas the colour of *T. bimaculatus* varies from greenish yellow to red. The latter species feeds largely on the lower surface beneath a fine silken web, in or under the protection of which it lays its eggs; the former feeds and lays its eggs on both surfaces, and makes no web, but fastens its eggs by a few fine silken threads to the leaf or twig on which they are laid. The eggs are uniformly blood red, while those of *bimaculatus* are pearly white. *T. pilosus* passes the winter in the egg stage, these being deposited in the axils of the twigs and branches. *T. bimaculatus* passes the winter as adults in the ground or in sheltered hiding places.

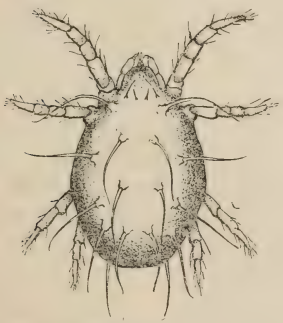

Fig. 5.—*Tetranychus pilosus*, adult female, greatly enlarged. (Drawn by Miss M. Hearle.)

The host plants of *T. pilosus* so far as observed are the European plum, apple, sour cherry, pear, peach and hawthorn. European plums are by far the favorites, with apples next and then sour cherries. Peaches and Japanese plums are very little infested. Hawthorns in a few apparently exceptional cases have been severely attacked.

Fig. 6. — *Tetranychus bimaculatus*, adult female, greatly enlarged. (Drawn by Miss M. Hearle.)

The foliage of badly infested trees becomes covered with numerous fine, whitish blotches very noticeable on the upper surface. After a time such leaves become brownish and at a distance of a hundred yards or more the whole of the foliage has the appearance of being covered with fine road dust.

This hitherto unrecorded Red Spider has been found by the writer in most of the fruit districts of the Province. That it has not been mentioned earlier appears to have been due to its close resemblance to our common species, *Tetranychus bimaculatus*.

GEOMETRID NOTES.—REVISION OF THE GENUS HYDRIOMENA, HUB., GROUP WITH LONG PALPI.

BY L. W. SWETT, BOSTON, MASS.

(Continued from page 11,)

17. **Hydriomena bistriolata** Zell. (Verh. zool.—bot. Ges. Wien, XXII, p. 493, 1872; Packard, Monograph, p. 95, 1876, Pl. VIII, fig. 32). This species with long palpi was placed incorrectly as a variety of *H. californiata* with which it has nothing in common. The general ground colour is dark olive-green and white. It is quite a striking species, as the entire wing seems to be surrounded with olive green and has a white mesial space. It appears like a specimen of *autumnalis* with the entire wing suffused with dark olive-green and the white central portion contrasting

sharply. There is a tendency for the extra-discal bands to unite at the inner margin of the wing. The entire outer margin is olive-green, not lighter near the outer margin as is usual. The median band is much wider than usual and the basal runs almost straight across the wing, slightly curved outward. The intradiscal band is strongly notched on the fore wing at vein 2. This seems to be a rare species and is in few collections. The specimens referred to in the Packard monograph from Kentucky and Missouri I do not think belong to this species, as the Kentucky specimen is *autumnalis*, while the Missouri specimen is not in the collection, but was probably returned to the sender, Dr. Riley, and should be in the National Museum collection at Washington. The palpi are very stout and the head is rather broad, so that it could not possibly be confused with *autumnalis*, and how it should be referred to the latter I cannot guess. I believe it is strictly Texan.

Types.—1 ♂ 10, Dallas, Tex., March 16 (Boll).

Type.—1 ♀ Texas (Boll) in Zeller collection.

It is a striking species and can be confused with no other.

18. **Hydriomena regulata** Pears. (Proc. Ent. Soc. Wash., Vol. XI, p. 131, 1909).

This is a peculiar species with olive and liver coloured shadings and has a little less than usual the general appearance of the Hydriomena group. The markings are not common for the Hydriomena, as I know of no other with liver coloured shadings, and I believe it to be rare, as the specimens in Mr. R. F. Pearsall's collection are all I have seen. It has no discal spots on primaries, the secondaries dusky and shaded with yellow brown.

Types.—2 ♂s, Douglas Ariz., Aug. 22 and 23, 1908.

19. **Hydriomena edenata** Swett. (Can. Ent., Vol XLI, p. 232, July, 1909).

This species is a large broad-winged one, on the pattern of *ruberata* Freger. It has a wide black bar just above inner margin of primaries which serves to separate it from *ruberata*, besides the other differences which I have already pointed out in the description. There is an error in the original description (Can. Ent., vol. XLI, p. 232, July, 1909), which I overlooked until now. Instead of "5 males" read "5 females," and instead of

"Eden Vale, Colo." read "Eden Vale, Calif." This species seems to have quite a wide range and is more common than the others. I had specimens from Mr. E. H. Blackmore, Victoria, B. C., and have heard that a specimen was even taken in Newfoundland, but cannot verify it.

Type.—1 ♀ in my collection, 4 ♀s, Mr. Broadwell's collection; 1 ♂ in Mr. J. G. Grossbeck's collection, which was sent me to compare.

H. edenata is an early species on the wing, occuring from April 5 to May 4, 1913, at Victoria.

20. **Hydriomena chiricahuata** Swett (Can. Ent., Vol. XLI, p. 231, July, 1909, Barnes and McD., Contrib. Nat. Hist. Lepid. North Am., Vol. I, No. 4, 1912.)

This species is figured by Drs. Barnes and McD. in their valuable work, in which a clear idea of the markings is given. It is quite a small and slender species and has a peculiar narrow mesial line, and the line on hind wings show only as dots. This is a very rare species and does not approach any other very closely, unless it looks superficially like a small *barnesata* with narrow mesial space.

Types.—2 ♂, Huachuca Mts. and Chiricahua Mts., Ariz., in Dr. Barnes' collection.

20. **Hydriomena similaris** Hulst, Trans. Amer. Ent. Soc., Vol. XXIII, 1896, p. 284.

This species is very closely allied to *ruberata*, from which it is difficult to distinguish. There is a peculiar pale blue and faded rusty look to the bands in *similaris*, while in *ruberata* they are bold and well defined and either smoky or brick red as the type species. *Similaris* occurs in June and July, while *ruberata*, to my knowledge, is only found in early May. This is rather a common form in Nevada, and, strange to say, is correctly labelled in most collections. How far it varies I cannot say, as my material has been somewhat limited, though it is not a rare species.

Type.—Colorado, Mr. Graef.

22. **Hydriomena ruberata** Freyer (Neu. Beit. Schmett., Vol. I, p. 67, pl. 36, fig. 2, 1831).

This little-understood species was first determined for Rev. G. W. Taylor by Mr. Lewis B. Prout of London, England. Mr.

Wolley Dod in his list (Can. Ent., Vol. XXXVIII, p. 253, 1906) also recorded it from Alberta. It did not seem to be clearly understood in Europe, for several of the older authors speak about varieties of *autumnalis* with long palpi and reddish markings. Freiherr Von Hoyningen-Heune in the Berl. Ent. Zeit., Vol. LI, p. 255, 1906, says that it is confounded with *autumnalis* in the majority of collections in Europe. It seems strange that Guenée and Packard did not note the length of the palpi, which would have separated it at a glance. The typical *ruberata* Freyer has a rust-red shading to the bands that cross the wings and rather a narrow mesial space; the mesial band, however, is quite wide. The discal dots are small and linear, and the hind wings are light ashen with two heavy, dark curved bands. Mr. Prout believes we have the true *ruberata* here in North America, as I sent him specimens to compare with European examples, and I have also specimens from Europe in my collection, which run very close to ours. I have not compared the genitalia as yet, and until that is done we can not be sure of its standing. There are several varieties which I am inclined to think occur in North America, namely, *literata* Donov. and *griscens* Hoyningen-Heune. *Ruberata* flies to light in New England in early May, and is more common in the mountainous districts, therefore I am inclined to believe it will be met with more commonly northward.

Hydriomena ruberata var. (a) **literata** Donov. (Brit. Ins., Vol. XIV, 1808, p. 80, pl. 499, fig. 2, 1810; Speyer. Stett. Ent. Zeit., p. 171, 1872).

Literata in the plate has white spots at ends of the veins, clear mesial space with discal spot like the letter T reversed. The discal spot does not seem to me a sufficient basis upon which to establish a variety, but the author's statement that it lacks the reddish markings and is grayish, that the bands are of the colour of the wings, and that it resembles *autumnalis*, except in the palpi, appears to justify its status as a variety. A form occurs here that is grayish without the red markings, and possibly it had better be referred to this variety until more is known of *ruberata*.

Hydriomena ruberata Var. (b) **griscens** Hoyningen Heune (Berl. Ent. Zeit., Vol. LI, p. 257, 1906).

This variety is a unicolorous gray and the bands and red shadings are lacking. It is like the unicolorous variety of *autumnalis*.

Hydriomena ruberata Var. (c) **glaucata** Packard (Proc. Bost. Soc. Nat. Hist., XVI, 20, 1874; Catal. of the Phal. of California, No. 2, Boston, Dec., 1873, Pl. I, fig. 6; Monograph p. 96, 1876).

The type is not in the Museum of Comp. Zool. at Cambridge, Mass., and I suppose therefore that it was returned to Edwards, its sender, as was Packard's custom, and should be in the American Museum of Natural History, New York. There is a specimen in the Edwards collection in the American Museum, New York, that answers closely to the description and figure,but unfortunately the head is missing, the most important part. The piece torn from the wing is as in the figure and the lines correspond, but it is impossible to tell where it belongs without the head. The plate is fairly clear and the figure shows the long beak-like palpi, and Packard speaks of them particularly in the description, so we know from the description at least where the type belonged. Since *ruberata* is the only closely allied species that has reddish shaded bands, with gray and unicolorous variations, and since we know green varieties always occur with red, it seems reasonable to suppose that this is a green variety of *ruberata* or else a closely allied species. This seems hardly possible, as I have specimens which agree line for line with *glaucata*, only they lack the red shading. I received a specimen from Mr. Broadwell which was green, and agreed with *glaucata* in every respect.

This form has broad full-rounded wings with five watery bands crossing them, and has a pale green ground colour with pale ashen hind wings.

Type.—1 ♀ (Edwards), Calif., probably in American Museum of Natural History, New York.

This includes all the species and varieties so far listed, and, I hope, will help to separate the many tangles. The genus *Hydriomena*, as a whole, seems a very compact and natural group, if we exclude the heterogeneous forms. The palpi and colour scheme seem to be very constant characters, and I believe eventually the other forms will be transferred to other genera. Surely

Coenocalpe magnoliata does not belong here, but until we know the genitalia and life histories better, we had better leave them as they are. Mr. Louis B. Prout is in accord with me that the larval characters and imagoes are quite distinct from those of the other species listed under *Hydriomena*. *Hera contracta*, for example, has a strong hooked clasper, which shows it does not belong to *Hydriomena*.

In regard to life histories, very little seems to be known of the American forms, but in Europe *H. furcata, autumnalis and ruberata* have been bred for years

I take this opportunity of correcting two errors of sex-signs, which appeared in former papers of mine on this genus. In the description of *Hydriomena henshawi* (Can. Ent., Vol. XLIV, p. 164, 1912) instead of "Type 1 ♂, Nevada," read "Type 1 ♀, Nevada." In the description of *H. nubilofasciata* Pack. var. *cumulata* Swett (Can. Ent., Vol. XLII, p. 281, 1910), instead of "Types 2 ♂, Feb. 6, 1874, Sanzalito, Cal." read "Types 2 ♀," etc.

I realize that the task of unravelling this variable group has been a difficult one, and that my work is incomplete, but I hope that I have at least made some of the puzzling forms more easily recognizable to the average collector.

Synopsis of Species and Varities.

14. *Hydriomena speciosata* Pack.—Green and white mottled.
Var. *agassizi* Swett.—Black and green.
Var. *taylori* Swett.—Green and brown.

15. *Hydriomena costipunctata* Barnes and McD.—Green and brownish purple.

16. *Hydriomena barnesata* Swett.—Green and white.

17. *Hydriomena bistriolata* Zell.—Green suffused, white mesial space.

18. *Hydriomena regulata* Pears.—Green and liver coloured.

19. *Hydriomena edenata* Swett.—Green and white (black bar).

20. *Hydriomena chiricahuata* Swett.—Green and white, narrow mesial band.

21. *Hydriomena similaris* Hulst.—Green with bluish bands.

22. *Hydriomena ruberata* Freyer.—Gray with reddish shaded bands.

22. *Hydriomena* var. *literata* Donov.—Gray, bands unicolorous.

Var. *griscens* Hoyn.-Heune.—Gray suffused, without bands.

Var. *glaucata* Pack.—Pale green, with gray bands.

GEOMETRID NOTES—DESCRIPTION OF A NEW VARIETY.

BY L. W. SWETT, BOSTON, MASS.

Hydriomena speciosata Pack., var. **ameliata**, n. var.

Expanse 31–33 mm. Palpi long and blackish; head and thorax greenish; abdomen light ashen. A narrow black bar at base of antennæ. Fore wings olive green, with a broad white mesial band. Base of wings blackish, with possibly the beginning of a black line; between base and first line of mesial band olive green, then another olive green space to the broad irregular black band, then olive green to the intra-discal band. The three irregular lines of the mesial band are very striking; the outer one nearest the discal dot projects outward on median vein, almost touching the dot, and is irregular on the veins. Beyond, the mesial space is greenish white, giving the insect a striking appearance. In some respects it resembles certain varieties of *H. autumnalis* that I have seen from Germany. The extra-discal line is very prominent on the costa and then runs irregularly in dashes across to the inner margin. Half-way between tip of wing and extra-discal line is a broad triangular black spot, which appears to be a broken line running in spots on the veins across the wing. A broad apical black dash. Fringe black and white checkered. Hind wings dark ashen brown with a pale checkered fringe. Wings beneath dark brown, with markings of upper side showing through.

This is the white-banded form that we should expect to find, according to my colour-scheme (vide p. 63), and I should not have described it were it not for its similarity to certain varieties of *H. autumnalis*, from which it can be distinguished by the long palpi.

Type.—1 ♀, Victoria, B. C., July 7, 1914. From Mr. E. H. Blackmore, to whose collection it belongs. It was taken at Garden City, a suburb of Victoria.

Paratype.—1 ♀, Victoria, B. C., July 9, 1914, in my collection, received through the kindness of the collector, Mr. E. H. Blackmore. It was taken at Swan Lake, a suburb of Victoria.

A NEW SPECIES OF THE MYMARID GENUS CAMPTOPTERA FOERSTER FROM AUSTRALIA.

BY A. A. GIRAULT, NELSON (CAIRNS), N. Q., AUSTRALIA.

Hymenoptera Chalcidoidea.

Family Mymaridæ.

Genus *Camptoptera* Foerster.

Camptoptera gregi, new species.

Normal position.

Female.—Length 0.40 mm. Minute.

Ashy black, the abdomen greyish, except toward tip; legs pallid yellowish, the antennæ ashy black, the scape and pedicel somewhat paler; both wings obscurely fumated throughout. Differing at once from the North American *pulla* and the European *papaveris*, the only other members of the genus, in having the first funicle joint abruptly shorter than the second, not long and nearly equal to it as in those species, but less than half the length of the second joint and distinctly shorter than the pedicel; also, *gregi* is smaller than *pulla* and has the abdomen paler; the first funicle joint is distinctly the shortest of the antennæ. Otherwise as in *pulla* or nearly.

(From one specimen, 2-3 inch objective, 1 inch optic, Bausch and Lomb.)

Male.—Not known.

Described from a single female specimen captured from the window of a residence at Nelson (Cairns), North Queensland, December 27, 1912 (A. P. Dodd).

Habitat.—Australia—Nelson, Queensland.

Type.—No. *Hy 1343*, Queensland Museum, Brisbane, the foregoing specimen on a slide.

On February 12, 1913, 9 females were captured in the same place.

Respectfully dedicated to Mr. G. R. Greg for his "The Creed of Christendom."

BOOK REVIEW.

THE ACRIDIIDÆ OF MINNESOTA. By M. P. Somes, University of Minnesota, Agricultural Experiment Station. Bulletin 141. University Farm, July 1914. 100 pp., 4 pls. (3 coloured).

Although a descriptive account of the Orthoptera of Minnesota has already been published* the present bulletin on the family Acridiidæ or short-horned grasshoppers will be found to contain much additional information on the distribution, habitats and life-histories of the species described in the earlier work, as well as descriptive notes on 16 species not included in the latter. It also contains keys for the identification of the subfamilies, genera and species.

No fewer than 78 species are listed, a number which exceeds the Ontario list by 30 species; but this is not surprising in view of the geographical position of the state and its relations to the Mississippi Valley and to Lake Superior. Minnesota lies on the borderland between the prairies and the eastern forest region, so that the rich prairie fauna, which is an almost negligible quantity in Ontario, is abundantly represented here, while Carolinian species enter by the Mississippi Valley and Canadian species find their way into the northern counties, the proximity of Lake Superior probably favouring the boreal element in the fauna of this section.

On account of these relations it is to be regretted that the author has not given us some account of the topography of Minnesota from the standpoint of locust distribution, particularly as this phase of the subject was also ignored in Lugger's report.

Many interesting notes are given on the manner of flight, habits of oviposition, etc., of the various species, one of the most noteworthy being the observation of a female of *Melanoplus blatchleyi* in the act of drilling a hole in a piece of dead wood after the manner of *Chloealtis conspersa*, a habit unusual among the Melanopli.

The figures on the plates are all from original drawings, mostly in colour and, with a few exceptions, are fairly accurate and very attractive in appearance. The figure of *Arphia sulphurea*, however,

*Lugger, Otto. The Orthoptera of Minnesota. Third Am. Rept. of the Entomologist of the State Experiment Station of the University of Minnesota, 1897.

appears to be a composite of two species, the head and thorax resembling an Arphia fairly closely, but the wings belonging unmistakably to *Circotettix verruculatus*. A number of photographs of habitats and several maps showing the distribution of certain species also appear as text figures.

The following somewhat misleading statements have been noted in the text:

On p. 22 the author states that Bemidji, Minn., where *Chloealtis abdominalis* was taken, "is doubtless near the eastern extreme of the range of this species, which has hitherto been taken in Montana and North Dakota." This species has been recorded from several localities in Ontario and Northern Michigan, ranging eastward beyond Georgian Bay.

On p. 23 *Dichromorpha viridis* is stated to be "common throughout North America," whereas it has never been reported from any part of Canada.

On p. 26 *Mecostethus lineatus* is spoken of as a very rare insect, ranging from New England to Northern Indiana, Illinois and Iona." In Canada it ranges northward at least as far as Anticosti Island, Temagami District, Ont., and Nipigon, Ont., and is abundant in almost all open marshes in Central and Southern Ontario.

On p. 30 *Gomphocerus clepsydra* is treated as a distinct species from *G. clavatus*, whereas it has for some years been generally regarded as a synonym of the latter.

These are minor matters and detract but little from the value of a useful and interesting account of this attractive group of insects.

Some South Indian Insects and Other Animals of Importance. By T. Bainbrigge Fletcher, Imperial Entomologist to the Government of India. Printed by the Superintendent, Government Press, Madras, South India, 1914.

As a worthy sequel to "Indian Insect Life," published in 1910 by Maxwell Lefroy, we have this book on the commoner insects of South India, with particular reference to economic forms. It is the first book of its kind produced in South India, and only the second in the whole country, and as such deserves special credit.

It is a quarto volume of 565 pages, and is illustrated with 50 splendid plates and 440 text illustrations. Most of the plates are coloured, and it speaks well for the author and his staff that these profuse, and on the whole, excellent illustrations are mostly original.

The work covers a very wide field, and may be divided into two parts. The first nine chapters deal with insects in general, their zoological status, structure and classification, their habits and the laws which govern them; and the tenth and eleventh chapters deal with pests in general and various means of control, specially adapted to local conditions. Then follow general descriptions of different insects classified as pests of crops and grain, as household pests and as carriers of disease, and the extent to which some are beneficial and useful. One chapter is devoted to a few other animals and birds, both beneficial and injurious. An important section, and one which will be valuable to its readers, is a long list of the commonly-grown plants and crops, with the names of some 800 insects attacking them, and a list of allied plants grouped under natural orders for reference when studying polyphagous insects.

The second and main part of the book is taken up with a study of the orders of insects, dealing mainly with injurious forms under the headings of references, distribution in South India, life-history, food plants, economic status and means of control. This represents an enormous amount of information condensed to a systematic and readily available form, and the profuse illustrations are intended to facilitate the tracing out of any particular insects which may prove injurious. The fact that many of the life-histories are classed as "not worked out" should be a stimulus to entomologists in India. The book ends with a complete index.

The author is to be congratulated on a stupendous work which he confesses was undertaken unexpectedly and executed largely by the exertions of the Madras Department of Entomology in the short space of two years. As a handy and popular work on insects, the book should prove of great value to planters and those interested in entomology, and the low price of six rupees (two dollars) places it within the reach of most people.

G. J. SPENCER.

Mailed February 11th, 1915.

The Canadian Entomologist.

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POPULAR AND ECONOMIC ENTOMOLOGY.

IMPORTANCE OF OBSERVATIONS ON APPARENTLY UNIMPORTANT INSECTS.

BY F. M. WEBSTER, BUREAU OF ENTOMOLOGY, WASHINGTON, D. C.

In the course of the writer's somewhat extended experience in the investigations of insects, with especial reference to their economic significance, he has occasionally found himself confronted with criticisms on account of having apparently expended both time and funds in studying insects whose attacks were, or had been, so far as known, of little or no importance. It therefore seems not out of place to direct attention to a number of instances showing that such restrictions are not always warranted and that the present status of importance of a species cannot be taken as conclusive respecting its future, or indeed near future significance.

Selecting a number of instances in point from my own experience and of others working under my direction, that of *Myochrous denticollis*, the southern corn leaf beetle, which has since become better known by reason of its disastrous attacks on growing corn in Kansas and southern Ohio, may be first mentioned. The first observations made on this insect in the corn field were purely accidental.

The writer happened to be passing through a field of young corn in Tensas Parish, La., in April, 1887, and observed a few of these beetles attacking the plants by gnawing the outside of the stems. There was nothing observed at the time that would indicate the least likelihood of this ever becoming a serious pest, such as it has since proven itself. To have passed over the fact without mention would have been to fail to record the basic observation on the insect as a corn pest.

Curiously enough, during the same month in the same locality the adults of *Ceratoma caminea* were observed attacking cultivated beans in the garden of an old negro, whose cabin was located in

the midst of the Tensas swamps. Although the writer had been familiar with the beetle for years in the North, this was the first time its food plant had ever been determined by him. With this initial observation in mind, the same insect was afterwards observed to attack the leaves of the cow-pea in great numbers. At that time the two observations did not give any basis for assuming that the species would ever become a serious enemy of the bean and much less so of the cow-pea, such as has since been recorded of it.

In the same locality reports were received of peculiar injuries to growing corn which had been observed by planters in previous years. No definite information was just at the time obtainable from this source, and it was not until later, when the writer stumbled, as it were, upon the larvæ of *Diabrotica 12-punctata* in considerable numbers, attacking the growing corn in the fields, that anything definite was known. With this limited knowledge, later observations seemed to be more easily made, with the result that a damage of 75% was observed a week or ten days later in other corn fields.

When Mr. Jas. A. Hyslop made his first observations on the clover root curculio, *Sitones hispidulus*, in April, 1909, there was no indication that the species was of any particular economic importance. It happened to be convenient for Mr. V. L. Wildermuth to continue the work taken up by Mr. Hyslop, because of the latter's transfer to Pullman, Washington, so there was even yet no information obtained that could be presented as an excuse for spending much time upon it. However, the investigation was carried through to completion, and in presenting the matter for publication we found ourselves somewhat at a loss to give satisfactory reasons for asking for the publication of the completed work. The injuries of the larvæ to the roots of clover were so infrequent, and the beetles themselves were not found in any great abundance, so that the species could not be placed among those particularly destructive to the clover plant. Five years later, however, in 1914, the larvæ of the same insect were found to be seriously destructive in alfalfa fields, attacking the alfalfa roots in precisely the same way in which Mr. Wildermuth had observed them to attack the roots of clover. It now turns out that an obscure, though serious trouble, in alfalfa fields which has, up to the present time, puzzled agronomists was really due to the subter-

ranean attacks of the larvæ of this species on the roots of alfalfa. Thus, within five years, this insect has advanced from one of apparently little or no economic importance, to one of the pests of the alfalfa field that must be reckoned with by alfalfa growers in future.

In 1909 Mr. Hyslop, in his entomological investigations about Pullman, Washington, found that the larvæ of the moth *Autographa gamma californica* attacked alfalfa plants, but these injuries were encountered so rarely that there did not appear to be any good reason for paying any special attention to the species. It was, however, convenient to carry on the observations, and in doing this Mr. Hyslop became impressed with the possibility that, in the event of its natural enemies becoming so reduced as to be unable to hold the species in check, it might become an insect of much more economic importance than his observations at that time would indicate. But, here again, it was difficult to explain, clearly, the necessity for the expenditures of time and funds required to carry out the investigation of the species, or to ask for the publication of the results. During the summer of 1914 the very conditions that it was thought might possibly come to prevail, did actually develop. Something transpired to prevent the development of the natural enemies of *Autographa*, in sufficient numbers to keep the pest in check, and as a result, throughout a number of the northwestern States, the species became a veritable scourge, and many letters were received complaining of its ravages.

In June, 1884, *Toxoptera graminum*, now better known as the notorious green bug, was introduced into a breeding cage in northern Indiana, where the writer was temporarily located. Up to that time the species was not known to occur in America excepting at one point, Cabin John Bridge, Maryland, a few miles north of Washington; and while, as later examination of the old records show, that the species had probably been injurious in Virginia two years prior to that date, at the time of the accidental introduction into the writer's breeding cages, it was not known as a destructive insect at all, and therefore the investigation made at that time was barely warranted by its then economic importance. Since that time it has come to be one of the most destructive pests of the grain field, and is probably more dreaded by the grain growers of

northern Texas, Oklahoma, and southern Kansas than any other insect.

Stictocephala festina has not until within the last year or two come to be known as an insect of any economic importance. A few years ago Mr. R. A. Cushman, at that time connected with the southern field crop insect investigations, found a few individuals girdling the stems of alfalfa in Louisiana. The species was, so far as known, of so little importance that a careful investigation was hardly justifiable. Later on its capabilities for seriously injuring the alfalfa became apparent, but still there was not sufficient information at hand to indicate that it would be likely at any time to become a serious pest. It was, however, carefully studied further by Mr. Wildermuth, and suddenly, from out of a stage of obscurity, so far as its alfalfa-destroying habits are concerned, it has jumped into prominence, by becoming seriously destructive during the summer of 1914 in the alfalfa fields of Virginia and some other States.

Other similar instances might be brought forward, but the foregoing is sufficient to show the absolute necessity of carrying out, judiciously, investigations of insects likely to become injurious, whenever a favourable opportunity presents itself for doing so, regardless of what the previous record of these may have been. It has frequently happened that certain species have, to all appearances, come suddenly into prominence and become immensely destructive to crops. Because of their previous supposedly lack of importance, no one having taken the time to investigate them, all inquiries for information relative thereto coming from those who suffered from their ravages, must be given the disappointing information that nothing whatever had been learned of their habits in any of their several stages of development. There are times when an entomologist may be and is criticised for what might appear as a wasteful use of both time and funds in investigating insects not previously known to affect in any way the interests of husbandmen. But let him totally neglect these, and when one of them suddenly jumps into prominence, as is sooner or later bound to be the case with some of them, he will find himself equally, or perhaps even more, severely criticised because he thus finds himself unable to give a full explanation of the activities

of the pest and advise methods of control. All of this goes to emphasize the necessity of investigating carefully, and as thoroughly as possible, using proper judgment of course, insects and their attacks upon vegetation, regardless of whether they are at the time injurious or not. It may be that, even at that very time, the insect is seriously injurious, but its injuries are of such an obscure nature as to be overlooked entirely or perhaps confused with those of some of the older and better known pests. Entomological investigations cannot be undertaken, carried through, and completed by contract, as the erection of buildings, construction of railways, or excavating of canals, but opportunities must be judiciously seized upon, and if the problem is followed faithfully wherever it may lead, one will be surprised at the number of instances like the foregoing, when the final outcome has more than justified the investigation.

NOTES ON THE PUPATION OF THE HOUSE-FLY (*MUSCA DOMESTICA*) AND ITS MODE OF OVERWINTERING.*

BY C. GORDON HEWITT, D. SC.
DOMINION ENTOMOLOGIST, OTTAWA.

The migratory habit of the larvæ of *Musca domestica* evidenced prior to pupation has been observed by most of the investigators who have studied the insect's life history, and these observations have been collected by Hutchison (1914). Levy and Tuck (1913) appear to be the first workers to call attention to the practical value of this habit in fly control, and Hutchison has extended the work along lines that will undoubtedly provide us with an additional means of control of no little value. The principle involved is the capturing of the mature larvæ leaving the manure to pupate, in accordance with their usual custom, either in the cooler outer portions of the piles or in the subjacent soil.

The migratory habit of the larva has also another interest, namely, its relation to the suppression of flies breeding in the usual type of insanitary privy and in latrines. While a few isolated observations have been made in India and elsewhere, I do not know of any exact record of the extent to which the larvæ migrate

* Contribution from the Entomological Branch, Department of Agriculture, Ottawa.
March, 1915

from the substance in which they have been feeding. Hutchison (*l.c.*) found that the majority of the pupæ were scattered about the drier margins of the heaps of horse-manure, sheltered by the overhanging straw, and that whereas, in one heap, he found about 9000 pupæ in this position, not more than 100 were found below the soil. In this connection the following observation appears to be worthy of record.

Following the experiments which I carried out (1914) on the control of the larvæ by various insecticides, it was decided to examine the soil around and beneath the untreated and consequently natural heap of horse-manure with a view to ascertaining the distance and depth travelled by the larvæ prior to pupation. Also it was desired to discover whether any of the insects were overwintering in the pupal state; to this aspect of the question I shall return later.

The manure was removed on May 13th and the soil subjacent to and around the site of the pile was carefully removed and an approximate record was kept of the numerical abundance of the puparia at the different depths below the surface of the soil to a distance of about four feet around the site. This task was carried out for me by Mr. S. N. Lord, to whom my thanks are due. The results of this examination of the soil, which was a sandy loam, are represented diagramatically in the accompanying figure.

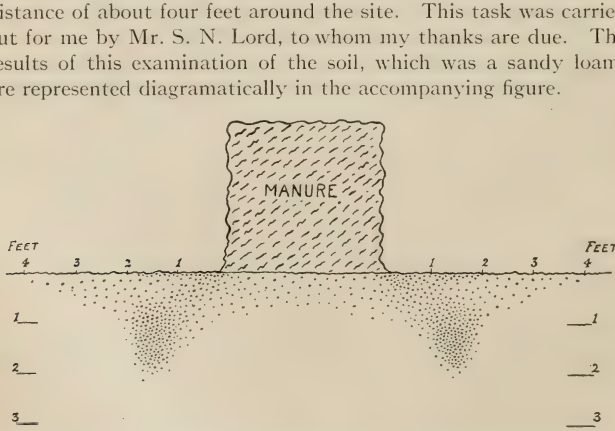

Fig. 7.—Diagrammatic section through heap of manure and subjacent soil to show the migration of the larvæ of *Musca domestica*. The drawing is to scale, distance and depth in feet being indicated. The black dots in the soil represent the puparia. (Original).

A few puparia were found directly beneath the manure pile to a depth of twelve inches. The greatest numbers occurred in the region about eighteen inches from the pile and at a depth of twelve inches to two feet from the surface; this is graphically shown in the figure; the puparia were also numerous immediately below the surface of the soil. The numbers then gradually decreased proportional to the distance from the pile and dwindled away at a distance of about four feet from its base.

This observation is of practical interest to the sanitarian as indicating the habits of the larvæ under normal conditions. It illustrates the ability of the flies to emerge from a depth of two feet, as particular attention was paid to condition of the puparia, and the flies had emerged from all the puparia other than those that had failed to develop.

The Overwintering of the House-fly

The question as to the state in which *Musca domestica* passes the winter has been discussed recently by several workers, and it seems desirable to review the subject again in so far as my experience of conditions in the most northerly temperate latitudes of England and Canada are concerned. In my monograph on the house-fly (1914) the statement is made that three causes contribute to the disappearance of the flies at the end of the summer, namely, retreat into hibernating quarters or into permanently heated places, natural death, and death from *Empusa muscæ*. I must confess that the word "hibernation" has been used in too broad a sense by me, as it has not only implied a dormant state during the winter, which is the usually accepted meaning of the term, but it has also had reference to a possible and sometimes actual state of activity during the winter months. It is in this sense that the word "hibernation" was used, as will be gathered in reading the section under that heading, in the work referred to. It would be preferable to substitute the term "overwintering," as this will adequately cover all conditions and developmental stages and will avoid a possible misuse of the term "hibernation."

Taking all the evidence that is now available, it may be stated that in northerly latitudes *Musca domestica* exists in the overwintering period in the following states:

1. *Dormant.*—In cool retreats where suitable shelter and protection may be found; here flies may truly hibernate.

2. *Periodically active.*—In premises where an increased temperature produces activity in the fly which would otherwise be inactive and dormant.

3. *Permanently active.*—The gradation between the former state, and this would be governed by temperature and the presence of food. Permanently active flies have been found by myself and other observers in every month of the winter season from November to March. I have dissected such flies from December to March and found them capable of reproduction in many instances. Such flies are found in warm bakehouses, kitchens, restaurants and stables. Jepson (1909) used such flies for breeding experiments in February.

4. *In the immature stages.*—The previous states, Nos. 1 to 3, are based on actual observations. That in northerly latitudes *M. domestica* may be found in the developmental stages (egg, larva or pupa) is a statement that has only, so far as I know, a theoretical and experimental basis. It should be possible, one would think, to find *M. domestica* breeding in permanently warm places, such as stables where larval food is present. In many stables, however, the temperatures are very variable, and this fact would lengthen the different stages very considerably. Personally, I have so far failed to discover evidence of *M. domestica* breeding under natural conditions during the winter months in the latitudes of Ottawa (Canada) and England, but observations indicate the possibility of such an occurrence in the presence of suitable conditions.

In the light of the evidence at present available, I think we are still justified in regarding the dormant and periodically active states during the overwintering period as the usual occurrence in northerly latitudes. But there is no doubt that where circumstances render state No. 3 possible, it contributes very materially to an increase in the number of available and active flies early in the spring. I have always held the same view as that suggested by Copeman and Austen (1914): "That the relative lateness of the season at which house-flies annually become abundant may be due to the smallness of the number of individuals that, in an active condition, survive the winter in houses or other buildings." This

idea was supported by my observations in the state of the reproductive organs of a portion of the flies found and dissected during the winter months.

The last contribution to our knowledge on this subject is the report of Copeman and Austen, quoted above, on the results of an examination of the species of flies collected in houses, etc., during the winter months. They state: "In conclusion, it would appear that the customary explanation of the perpetuation of the house-fly from year to year has now been fairly tested, and that the evidence obtained fails to support it. If, however, during the season of greatest fly-prevalence, a selection were made of several centres in which house-flies were present in sufficiently large numbers, it would be worth while during the following winter to endeavour to discover whether living pupæ could be found in any considerable quantity in the local breeding-places."

One serious objection prevents my agreement with their conclusion. The evidence contained in their report points to the fact that practically all the specimens of *M. domestica* that were received were caught in an active condition, and there is no evidence submitted to show that any of their correspondents found these flies as a result of searching for them in the hiding places from which Jepson and I have recorded them. In view of this objection the facts submitted by Copeman and Austen cannot be fairly considered as failing to support the explanation usually given. I may say I have repeatedly applied the test they suggest, and in no case have I been able to find either in England or Canada living pupæ of *M. domestica* under outdoor conditions during the winter. Nor has it ever been possible in my breeding experiments in Canada and in England to carry the insect through the winter in the pupal state. In the experiment described in the first part of this paper a special effort was made to find living puparia among several thousand examined, and not a single healthy puparium was discovered; all were either empty or had failed to develop. Had specimens been overwintering in the pupal condition, it is reasonable to expect that living puparia would have been found in the early part of May, as the adults could not have emerged earlier than that date under Ottawa conditions. It is a matter, however, that requires more observations in different localities, but until evidence is secured

of the insect overwintering in the pupal state we shall be justified in believing from the facts available that in northerly latitudes *Musca domestica* is accustomed normally to overwinter in the adult state.

In more southerly latitudes, where the mean temperature is much higher and where the activity of the flies is practically continuous throughout the winter months, one would expect the occurrence of the insect in an active condition and of the various stages of its development during this period, although the duration of such developmental stages would be lengthened. This has been found to be the case in New Orleans, Florida, in the valuable investigation of the Bureau of Entomology of the United States, Department of Agriculture, according to the verbal statement of Mr. F. C. Bishopp.

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2. *Hewitt, C. G.*—"Further Observations on the Breeding Habits and Control of the House-fly, *Musca domestica*." *Journ. Econ. Ent., Vol. VII, No. 3, pp. 281-289, 2 pp., 1914.*

3. *Hewitt, C.G.*—"The House-fly *Musca domestica* Linn. Its Structure, Habits, Development, Relation to Disease and Control," *pp. XVI+382, 104 figs. and map. Cambridge Univ. Press (England), 1914.*

PHYLLOPHILOPSIS, new name—*Phyllophila* Townsend, Proc. Biol. Soc. Wash., XXVIII, 21, is preoccupied, and *Phyllophilopsis*, new name, is hereby proposed to take its place.

CHARLES H. T. TOWNSEND.

NEW EXOTIC TIPULIDÆ (DIPTERA).

BY CHARLES P. ALEXANDER, ITHACA, N. Y.*

The following species of crane-flies have been received from various correspondents during the past year.

Genus *Dicranomyia* Stephens.

1829. *Dicranomyia* Stephens; Cat. Brit. Ins., Vol. II, p. 243.

Dicranomyia fullowayi, sp. n. (Fig. 8).

Small, body coloration brown; wings hyaline with grey spots; *Sc* short, ending opposite the origin of *Rs*.

Male.—Length 3.8 mm.; wing 4.8 mm.

Rostrum and palpi dark brown. Antennæ short, dark brown. Head brownish grey.

Fig. 8.—Dicranomyia fullowayi.

Thoracic dorsum brown without distinct stripes or markings of any kind; postnotum brownish grey. Pleuræ dark brownish black. Halteres light yellow. Legs with the coxæ and trochanters dull yellow; femora brown, paler at the base; tibiæ and tarsi brown. Wings hyaline or nearly so with grey spots as follows: At end of *Sc* and origin of *Rs* at end of R_1 and cross-vein *r*, along the cord and outer end of cell *1st* M_2, a blotch in the middle of cell *2nd* R_1 near the costa, a large blotch on vein R_{4+5} clouds at the ends of most of the veins, a blotch on *M* before the middle, a blotch at the arculus, two large spots in cell *1st A* touching vein *2nd A*. Venation as in figure—*Sc* short ending about opposite the origin of *Rs*, *Rs* half again as long as the deflection of R_{4+5} cell *1st* M_2 very long, basal deflection of Cu_1 just beyond the fork of *M*.

Abdomen dark brown, the last segment and the ovipositor more yellowish.

Habitat.—Island of Guam, Ladrones.

*From the Department of Entomology, Cornell University.

Holotype, ♂, Guam, Ladrones, D. T. Fulloway, coll. No. 1384.

Dicranomyia guttula, sp. n. (Fig. 9.)

Brown; wings hyaline with gray spots along the veins; *Sc* short ending opposite the origin of *Rs*.

Female.—Length 4.5—5 mm; wing, 5.7—6.4 mm.

Rostrum, palpi and antennæ dark brown. Head grey.

Thoracic præscutum rich yellowish brown with indications of darker markings behind; scutum similar with an indistinct darker spot on either lobe in front; postnotum light brown with a faint whitish bloom. Pleuræ brown, the dorsal sclerites, including those of the neck, around to the halteres, dark brown. Halteres light brown, the knob darker. Legs with the coxæ and trochanters yellow, femora dull yellow, tibiæ and tarsi light brown. Wings hyaline, the veins with abundant grey spots at short intervals producing a speckled appearance. Venation as in the figure—*Sc* short ending just beyond the origin of *Rs*, *Sc*2 being exactly opposite the origin of *Rs*, cell *1st* M_2 long and narrow, the outer deflection of M_3 long and arcuated, over twice as long as cross-vein *m*, basal deflection of Cu_1 just beyond the fork of *M*.

Fig. 9.—Dicranomyia guttula.

Abdominal tergites brown, tip of the abdomen, including ovipositor, yellowish; sternites yellowish.

Habitat.—Lor Marquez, South Africa.

Holotype, ♀, Lor Marquez, Africa, C. W. Howard, coll. No. 14.

Paratype, ♀, topotypic.

From *D. irrorata* Enderlein (Zool. Jahrb., vol. 32, pt. 1, p. 74, 75, fig. V_1) this species differs in having *Sc* short and in having the spots on the wings confined to the veins.

Genus *Libnotes* Westwood.

1876. *Libnotes* Westwood; Trans. Ent. Soc. Lond., p. 505.

Libnotes picta, sp. n. (Fig. 10.)

Colour yellow, the thoracic dorsum with six rounded black

marks; wings hyaline with scanty brown spots including three along the costa; cross-vein *r* at the tip of R_1.

Male.—Length about 6 mm.; wing, 7.1 mm.

Rostrum yellowish, the basal segments of the palpi light brown, the apical segments dark brown. Antennæ with the basal segment brown, the remainder of the antennæ dull yellow. Head brown with a thick light grey bloom.

Thoracic dorsum light yellow, the præscutum with four black marks, a pair on either side of the middle line about midlength of the sclerite, contiguous on their inner faces; a larger mark on the sides of the sclerite near the end of the suture; scutum with a very large rounded mark on each lobe; scutellum with the caudal margin narrowly brown; postnotum with two pale brown rounded markings behind, one on either side of the median line, but separated from one another. Pleuræ yellowish white. Halteres pale, knob a little darker. Legs with the coxæ and trochanters pale yellow,

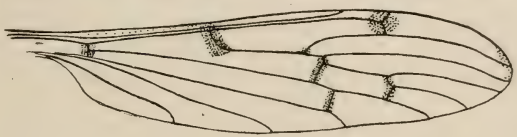

Fig. 10.—Libnotes picta.

femora light yellow, the tip narrowly dark brown; tibiæ dull yellow, the tip narrowly dark brown, tarsal segments 1 and 2 dull yellow, the tips narrowly darker, segments 3 to 5 brown. Wings hyaline with small brown marks as follows: a large rectangular blotch at the orgin of *Rs*, a rounded stigmal spot, narrow seams along the cord and along the outer end of cell *1st* M_2, the tip of the wing is narrowly infuscated, base of the wing in the vicinity of the arculus clouded with brown; veins yellow, brown inside the markings on the membrane. Venation as in figure.

Abdomen dull light yellow.

Habitat.—Island of Guam, Ladrones.

Holotype, ♂, Guam, Ladrones, D. T. Fulloway, coll. No. 1226.

By means of Osten Sacken's key to the species of this genus (Berl. Ent. Zeit., Vol. XXXI, pt. 2, p. 182, 183), *L. picta* would

run down to the first group of species, but runs out by its hyaline wings with spots. By de Meijere's key (Tijd. voor Ent., vol. 54, p. 33, 34) it would run down to *L. notata* Wulp, a much larger insect with entirely different body-coloration.

Genus *Molophilus* Curtis.

1833. *Molophilus* Curtis; Brit. Ent., p. 444.

Molophilus sirius, sp. n. (Fig. 11.)

Body coloration dark brown; hypopygium of the male with two pairs of chitinized appendages which are finely denticulate at the tip.

Male.—Length 3.5 mm.; wing, 5.4 mm.

Female.—Length 4.8 mm.; wing, 5.5 mm.

Rostrum and palpi dark brown. Antennæ broken. Head brownish grey, the occiput paler behind.

Pronotum and anterior margin of the mesonotal præscutum pale whitish yellow, remainder of the præscutum brown, the space before the pseudosutural foveæ yellow, the foveæ and tuberculate pits dark brown; lobes of the scutum dark brown; scutellum and postnotum brown. Pleuræ brown. Halteres with the knobs very large, elongate, stem brown, knobs paler. Legs with the coxæ and trochanters dull dark yellow, remainder broken. Wings hyaline or nearly so, the veins rather pale with abundant long dark brown hairs. Venation as in the figure.

Fig. 11.—Molophilus sirius.

Abdomen dark brown, the valves of the ovipositor brownish yellow. Male hypopygium with the ventral-lying pleural appendages fleshy, long, slender and finger-like, clothed with long hairs; underneath these fleshy lobes are a pair of chitinized hooks, straight basally, curved ventrad and inward at their tips and on the under face with several small teeth. Dorsad of these are a pair of shorter chitinized appendages, almost straight, the dorsal face near the tip with minute teeth. Dorsal lobes, short, rounded at tip, flat,

clothed outwardly with long pale hairs, on the inner or ventral face with numerous black chitinized points.

Habitat.—Phillippine Islands.

Holotype, ♂, Phillippine Islands, July. Labelled "F. Casey, Wash. Thru Miss Ludlow."

Allotype, ♀, topotypic.

Genus *Mongoma* Westwood.

1881. *Mongoma* Westwood; Trans. Ent. Soc. Lond., p. 364.

Mongoma guamensis, sp. n.

Fragillima group; colour dark brown; no white on the legs.

Male.—Length 6.8 mm.; wing, 7.1 mm.

Rostrum and palpi yellowish brown. Antennæ brownish yellow, the flagellar segments elongate, brown, clothed with abundant pale hairs. Head grey.

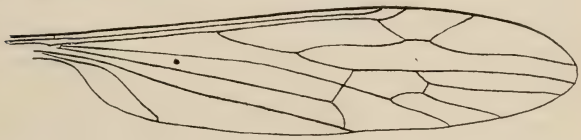

Fig. 12.—Mongoma guamensis.

Thoracic dorsum light brown, the pleuræ lighter coloured, more yellowish, especially ventrally. Halteres light brownish yellow, the knobs darker. Legs with the coxae and trochanters dull yellow, femora dark brown, paler at the base, tibiæ dark brown, tarsi much paler, almost yellow. Wings hyaline, the stigma indistinct; veins dark brown. Venation as in figure.

Abdominal tergites brownish grey; sternites more yellowish.

Habitat.—Island of Guam, Ladrones.

Holotype. ♂, Guam, Ladrones, D. T. Fulloway coll. No. 1385.

This species differs from all of the related regional species of the *fragillima* group by the lack of white on the legs, *pennipes* O.S., *tenera* O. S., and *pallidiventris* Brun. having the tarsi snowy-white. *M. cariniceps* End. from Sumatra is a very different insect from any of these species and is easily separated by its large size and orange colour. *M. albipennis* Meij. from Java is larger than *guamensis* and has the wings and veins whitish.

INQUILINE BUMBLE-BEES IN BRITISH COLUMBIA.

BY F. W. L. SLADEN, APICULTURIST, CENTRAL EXPERIMENTAL FARM, OTTAWA.

Having been informed by Mr. R. C. Treherne of a nest of bumble-bees in his garden at the foot of the mountain at Agassiz, B. C., I dug it up on July 7, 1914. The nest was found at about 18 inches from the surface. It contained an old queen of *Bombus flavifrons* and about half a dozen workers of the same species; also the well-preserved body of a female of *Psithyrus insularis* Sm., and several unopened cocoons, out of one of which I extracted a male, nearly ready to hatch, of *Psithyrus consultus* Frank. The occurrence of *Psithyrus* in this nest is of considerable interest, for Franklin said in his recent monograph of the Bombidæ of North America (Trans. Am. Ent. Soc. XXXV, page 448), "There is not yet a single new world account of a *Psithyrus* having been found in a bumble-bee's nest."

Moreover, several noteworthy conclusions are indicated.

Corroboration of a new and highly convincing kind is given to the already well-founded belief (id., page 458), that *consultus* is the male of *insularis*, for the female *insularis* was in all probability the mother of the male *consultus*. It may be remarked that the name *insularis* has priority.

Second, *Ps. insularis* is evidently parasitic upon *B. flavifrons* in British Columbia. In Eastern Canada (*insularis* is common at Ottawa) it must prey upon some other species of *Bombus*, for *flavifrons* is not found in the east. Probably, however, it lives with several species in both regions.

Third, *Ps. insularis* does not apparently kill the *Bombus* queen, as I have found *Ps. vestalis* and *rupestris* do in England ("The Humble Bee," page 60), but both females seem to live together in the nest, laying eggs. (The death of the *insuralis* female was evidently due to age or accident.) This seems to be in accord with Hoffer's observations on *Psithyrus campestris*, the Old World representative of *insularis*. He found *Ps. campestris* living on good terms with its hosts, *B. agrorum* and *helferanus*, both queens producing young (Die Schmarotzerhummeln Steirmarks, page 101).

A NEW APHID FROM FLORIDA.

BY GEORGE G. AINSLIE, WASHINGTON, D. C.

Carolinaia cyperi, n. sp.

Alate viviparous female—General colour black. Head, thorax and abdomen shining black, the latter with a greenish tinge in strong light. Eyes dark red, almost black. Antennæ black, appearing brownish in strong light, shorter than body, reaching beyond middle of abdomen, situated on very flat frontal tubercles, 6-segmented. Antennal segment VI with basal portion less than half as long as spur and shorter than IV, III about two-thirds as long as spur, five to seven, generally six, large round sensoria in a row on III, the usual ones at tip of IV and at base of spur. Rostrum dusky yellow, short, reaching just beyond first coxæ. Wings hyaline with strong black veins, stigma dusky, articulation greenish, venation of fore wings regular, hind wings with but one cross vein. Legs dusky yellow, tarsi and distal extremities of femora and tibiæ black. Cornicles dusky yellow, sometimes with reddish tinge, robust, swollen on inner side, largest about two-thirds out from base, with a sharp constriction and a flaring ring at tip which is turned slightly outward, carried closely appressed to the body pointing toward the cauda. Cauda dusky yellow, conical, retracted in life.

Measurements—Length of body 1.40 mm., width .65 mm. Length of antennal segments: I .071 mm., II .053 mm., III .212-.265, aver. .245 mm., IV .141-.177, aver. .157 mm., V .159-.194, aver. .177 mm., VI base, .123-.159, aver. .147 mm., spur, .335-.406, aver. .378 mm. (averages from ten antennæ). Total length 1.213 mm. Wings, fore wing, length 2.29 mm., width .84 mm., hind wing, length 1.21 mm., width .33 mm., total wing expanse 5.15 mm. Cornicle, length .212 mm., width .053 mm. Cauda, length .106 mm.

Apterous viviparous female—General colour black with a sepia tinge and shining with a metallic lustre. Surface of head, thorax and abdomen minutely rugose or shagreened. Body flattened, turtle-shaped, with lateral margins prominent and often furrowed. Antennæ 6-segmented, I, II, V and VI dark with yellowish tinge, III and IV paler, the articulation between III and IV though

sometimes not complete is always indicated, a single sensorium near tip of IV and the usual group at base of spur. Legs dusky yellow, tarsi and distal extremities of femora of second and third pairs darker. Cornicles and cauda as in alate form, the former closely appressed to the abdomen in life.

Measurements—Length of body 1.63 mm., width .93 mm. Length of antennal segments, I .07 mm., II .05 mm., III .14-.176, aver. .16 mm., IV .088-.124, aver. .10 mm., V .106-.124, aver. .12 mm., VI base .088-.106, aver. .10 mm., spur .212-.247, aver. .23 mm., total length .839 mm. Cornicles, length .265 mm. Cauda, length .088 mm.

Pupa—Head, thorax and abdomen dark mottled green. Antennæ dusky yellow at base, shading to almost black at tip. Eyes dark red. Wing pads pale yellow with greenish tinge. Legs pale yellow. Cornicles as in alate form, though more robust. Cauda not apparent. Length of body 1.26 mm., width .79 mm.

The young are pale yellow or greenish when born and gradually darken as they approach maturity.

The species agrees well with Wilson's definition of the genus, except that the apterous forms have indistinctly 6-segmented antennæ instead of 5-segmented as he gives it. The division between III and IV is plainly indicated in all the specimens I have seen and in many is complete.

This aphid was first found at Lakeland, Florida, in November, 1912. Further observations were made during the following winter and during the winter of 1913-14. Specimens were sent to Mr. J. J. Davis and Mr. J. T. Monell, both of whom pronounced it a new species of *Carolinaia*. I am indebted to them and especially to Mr. J. J. Davis for assistance in the preparation of this paper.

The species appears to be rather generally distributed throughout Florida, for it has been taken at a number of places throughout the state and as far north as Gainesville. *Cyperus esculentus*, which in its wild form is the pestiferous nut-grass of the south and in cultivation is known as the chufa, is its only observed food plant. It thrives on chufa in cages and colonizes it readily when available in the field. Other species of *Cyperus* growing in close proximity to infested plants of *esculentus* were examined repeatedly, but the aphid was never found on them.

Notwithstanding its dark colour, it is a very inconspicuous species, for it lives only on the under side of the leaves, where it forms large colonies, the apterous adults lying in a single regular row on each side of the midrib with the small forms crowded in among them. It is surprising how many can exist in this way on the lower side of one leaf. No matter how crowded they may be on the under surface, they never feed on the upper surface, and the leaves seem never to show the slightest effect of their presence. The alate forms are very seldom found in the larger colonies, for they leave the group as soon as matured to establish new ones on uninfested plants.

It has not been followed throughout an entire season. When first found in November the colonies, then rather small, consisted of apterous adults, young, and an occasional alate form. In January almost every plant in the field bore large colonies, but winged adults were very scarce. When, however, some of the infested plants were transferred to a cage, winged forms appeared at once, indicating that they had been developing, but leaving the parent colony as soon as mature. The large colonies persisted in the field and became very abundant until about the middle of March, when predaceous enemies began to make serious inroads upon them. Previous to this the weather, while not freezing, had been cool enough to suppress most insect activity. From this time on the colonies grew smaller and more scattered, for Coccinellids and Syrphids became so numerous that no colony long remained unmolested. Small scattering colonies were still present at the time of my last observations late in May. No sexes have been found, and it is most likely that the species can winter exposed on its food plant in any normal season. In evidence of this, I have just received a letter from Mr. R. N. Wilson from Gainesville, Florida, dated November 27, 1914, in which he states that a recent cold snap froze the nut-grass back to the ground, and that the aphids are not numerous, but at the same time he sent a good supply of them taken in the open. How they fare in summer, when the unshaded sand is heated to 130 to 150 degrees F. by the sun, I have not had opportunity to observe.

Coccinella sanguinea and *Baccha clavata* were the most common of the predaceous enemies though other species of Coccinellids

and Syrphids were present in smaller numbers. Numbers of parasites were reared from the larvæ and pupæ of these predators, among them several undescribed species of Hymenoptera. Internal parasites were not in evidence, and only a few aphids killed by them were seen. Possibly in summer they are more efficient. Aside from insect enemies, the most serious foe of the nut-grass aphid is the hard dashing rain, which becomes more frequent in May and June. The fine sand is driven against the lower surface of the leaves with such force by the splashing rain-drops that most of the aphids are beaten off or killed, and after two or three such showers it is often difficult to find more than a few scattered individuals.

Records of a few individuals more closely observed follow. On January 20 a migrant taken from the field was put on a potted nut-grass plant. While the plant remained fresh apterous adults developed, and by January 31 a number of these were producing young February 2 the original migrant was still producing young, but the plant had begun to deteriorate. February 11 the plant was practically dead, killed by a larva of *Bactra lanceolana*, so the few aphids remaining were transferred to a fresh plant. February 19 alate forms began to appear, and between that date and April 7, when the plant finally died from neglect, 181 winged forms were removed, practically all that were produced during that period having developed wings.

An alate vivipara maturing January 22 was placed on a caged plant. Up to March 6, when she disappeared, she had given birth to 51 young at the rate of one, two or three per day.

THE SYMMETRY OF INSECTS.

BY HARRY B. WEISS, NEW BRUNSWICK, N. J.

All insects are bilaterally symmetrical, or, in other words, the two lateral halves of an insect are alike, and symmetry can be defined as a pleasing equality of parts. Bilateral symmetry is sometimes known as horizontal dual symmetry, inasmuch as bilaterally symmetrical objects are usually oriented from a middle point or portion and exploited by equal movements of the eyes to the right and to the left, which is the natural method. As a result,

the aesthetic value of dual symmetry is greater in the horizontal than in the vertical.

In addition, other forms of symmetry can be found in insects, due to the arrangement of wings, venation and colour patterns. In fact, aesthetic appreciation of insects is due to many factors, among which are symmetry, proportion, intensity and arrangement of colours and experience and familiarity with the insects in question.

In the Lepidoptera horizontal dual symmetry is quite common, but in addition the lateral halves of many members possess radiating symmetry by reason of radiating wings and veins. The repetition of certain designs or colour spots arranged in curves or lines can be called running symmetry, and at times rotating symmetry is found, as, for example, the circular spots of *Automeris io*. In a few instances lepidopterous insects are exploited by movements of the eyes above and below the horizontal line formed by the posterior edges of the first pair of wings. In many individual butterflies and moths nearly all of the above forms of symmetry can be found, and when such a multiplicity occurs the insect assumes a complexity, which may or may not, according to one's training, be viewed with æsthetic pleasure.

Members of the Diptera possess in the main horizontal dual symmetry, and at times radiating symmetry of the wing veins. Many of the Hymenoptera present radiating symmetry due to their narrow wings radiating from the thorax, although all four elements are not equal. In mounted specimens the arrangement of the legs also tends to induce divergent radiating exploitation.

In the Orthoptera the expanded hind wings of the Acridiidæ contain intense radiating elements, and many of the Odonata possess a four-fold radiating symmetry due to the radiation of their narrow equal wings. In the majority of the Orthoptera and Hemiptera dual symmetry in the horizontal is most apparent. While some members are exploited in different ways, very few of such movements induce what is known as æsthetic pleasure.

Many of the Coleoptera, in addition to possessing horizontal dual symmetry, which is not very apparent at times, also exhibit proportion or a pleasing inequality of parts shown in the proportion between the length and width of the insect. To many persons

the rectangle is more pleasing than the square because of its variety. For example, the Coccinellidæ are not as pleasing as to form as the Elateridæ. Symmetry at times becomes monotonous. Some members of this order are exploited horizontally from the vertical line formed by the inner edges of the wing covers and others, vertically above and below the upper edge of the abdomen or markings on the abdomen, while still others will impress one at the first only with their pleasing or displeasing inequality of parts.

Some of the Odonata also exhibit a pleasing inequality of parts, especially those which are T-shaped when spread.

Aesthetic pleasure depends in part upon certain habitual methods of orientation and exploitation, such as the movement of the eyes and attention upwards which is preferred to a movement downwards, a movement from the eyes of left to right, which is preferred to the opposite movement, and proportion, which is more pleasing in some cases than symmetry. As mentioned before, symmetry and proportion are only two of the many factors contributing to the total result known as æsthetic appreciation of insects.

THE CADDIS-FLIES (TRICHOPTERA) OF JAPAN.—II.

BY WARO NAKAHARA, TOKYO, JAPAN.

(Continued from Vol. XLV, p. 327.)

Family Limnophilidæ.

Of this family I recognize six genera as occurring in Japan, viz., *Glyphotaelius*, *Nemotaulius*, *Grammotaulius*, *Limnophilus*, *Nothopsyche*, and *Moropsyche*.

Genus *Glyphotælius* Steph.

1. **Glyphotælius admorsus** MacLachlan.

Glyphotælius admorsus MacLachlan—Trans. Ent. Soc. Lond. (3) V, p. 250 (1866); Hagen, Verh. zool.-bot. Ges. Wien, XXIII, p. 446 (1873); Matsumura, Thous. Ins. Jap., I, p. 167, pl. XII, fig. 4, ♂ (1904); Ulmer, Cat. Coll. Selys, VI, p. 16, figs. 24 and 25, pl. I, fig. 4 (1907); Ulmer, Deutch. Ent. Zeit., p. 340 (1908).

Habitat—Hondo (Gifu, Okayama, Tokyo, Inokashira, near Tokyo, Osaka, Teganuma, etc.); Kiushin (Yanagawa, Prov. Chikugo).

Time of appearance—April to June.

2. **Glyphotælius miyakei,** sp. nov.

Head lurid reddish brown, covered with minute whitish hairs; vertex blackish; narrowly yellowish around eye; palpi fuscous. Antenna fuscous, some terminal joints suffused with yellow. Eye shiny black.

Pronotum covered with whitish hairs, divided in the middle by a longitudinal line. Mesothorax fuscous. Metathorax somewhat yellowish.

Legs yellowish, tibia II and tarsi of all legs more or less suffused with fuscous; spines black or fuscous black; spurs yellow.

Fore-wing tinged with brownish yellow, rather strongly produced at apex and sinuated at apical margin; apical half of the wing slightly clouded with greyish; hyaline oblique band in the discal area of the wing entirely wanting; a few black stripes and dots along cubital and anal veins; pterostigma quite indistinct; hind marginal area of the wing not marked with special colour.

Hind-wing hyaline, colourless, excepting the apical area and pterostigma, which are slightly tinged with yellowish; venation yellowish.

Abdomen dark brown above, somewhat paler on ventral side. In the male the 9th abdominal segment is produced at its posterior margin into a triangular portion, the edge of which is directed downwards and beset with few soft hairs; superior appendage small, piceous, and subquadrate; inferior appendage very large, not parted in the middle by an impressed line; penis very long, suddenly dilated a little before its apex, with a hairy accessory process on each side.

Length of body 13 mm.; fore-wing 20 mm.; hind-wing 16 mm.

Type—A single male obtained at Matsuyama, Prov. Iyo, Shikoku, in my collection.

This species is respectfully dedicated to Dr. T. Miyake, at whose suggestion and through whose kindness I was able to take up the study of Japanese caddis-flies.

This species is very closely allied to *G. admorsus*, but can be distinguished by the markings of the fore-wing and the structure of the male genitalia.

Genus *Nemotaulius* Banks.

3. **Nemotaulius brevilinea** (MacLachlan).

Grammotaulius brevilinea MacLachlan, Journ. Linn. Soc. Lond., Zool., XI, p. 107, pl. II, fig.1, ♀ (1871); Hagen, Verh. zool.-bot. Ges. Wien., XXIII, p. 453 (1873); MacLachlan, Rev. Syn. Trichopt. Europ. Fauna, p. 34 (1894); Matsumura, Thous, Ins. Jap., I, p. 169, pl. XII, fig. 7, ♀ (1904).

Nemotaulius brevilinea Banks, Proc. Entom. Soc. Wash., VII, p. 107 (1906); Ulmer, Genera Insectorum, Trichoptera, p. 40 (1907); Ulmer, Deutch, Ent. Zeit., p. 341 (1908).

Glyphotælius subsinuatus Ulmer, Notes Lyden Mus., XXVIII, p. 5, figs. 5, 6, ♂ (1906); Ulmer, Gen. Ins., Trichopt., p. 40 (1907); Ulmer, Deutch. Ent. Zeit., p. 341 (1908).

MacLachlan's original description of this species is sufficiently precise, except in that his types were females. There is no doubt in my mind that the form described by Ulmer under the name of *Glyphotælius subsinuatus* is the male of this species.

Habitat—Hondo (Gifu, Kangawa, Yokohama, Tsuchiura, Teganuma, Kyoto, etc.); Hokkaido (Sapporo); Shikoku (Matsuyama).

Possibly of general distribution in Japan.

Time of appearance—April to June.

Genus *Grammotaulius* Kolenati.

4. **Grammotaulius ornatus,** sp. nov.

Head reddish brown, covered with hairs of pale yellow; a rather deeply impressed longitudinal line on vertex; narrowly pale yellow around eye; maxillary and labial palpi fulvous brown, apical joint of the latter blackish; antenna yellowish, with rather indistinct brownish annulations.

Prothorax reddish brown with a median impressed line above; covered with minute pale yellow hairs; beset with long fuscous hairs on both sides. Mesothorax fuscous black; median part of notum reddish brown, furnished with minute tubercles and hairs; tegulæ brown, beset with long blackish hairs. Metathorax entirely dark brown. Legs yellowish; spurs and spines fuscous black.

Fore-wing semi-hyaline, slightly tinged with brownish yellow; an oblique broad hyaline band in discal area, both sides of the

band marked with large fuscous spots, several small fuscous spots in the area between radius and its sector; a large hyaline mark, with a few fuscous spots in, at the outside of discal cell; apical marginal area rather irregularly marked with fuscous.

Hind-wing hyaline and nearly colourless, slightly tinged with yellowish at apex.

Abdomen fuscous black, hind margin of most segments somewhat paler. Female with two slender, hairy processes at the apex of the abdomen.

Male unknown.

Length of body 13 mm.; fore-wing 16 mm.; hind-wing 14 mm.

The type is a single female in my collection. It was captured by Mr. Arakawa at Uwajima, Prov. Iyo, Shikoku, in May, 1913.

Genus *Limnophilus* Leach.

5. **Limnophilus correptus** MacLachlan.

Limnophilus correptus MacLachlan, Rev. Syn. Trichopt. Eur. Fauna. Suppl. II, p. 18, pl. LIII, fig. 3 (1880); MacLachlan, First add. Suppl., p. 5 (1884); Matsumura, Thous. Ins. Jap., I, p. 171, pl. XII, fig. 10, ♀ (1904); Ulmer, Deutch. Ent. Zeit., p. 341 (1908).

Limnophilus borealis Ulmer, Cat. Coll. Zool. Selys, VI (1), p. 17, figs. 26, 27 (1907), nec Zetterstedt.

(?) *Limnophilus borealis* Ulmer, Deutch. Ent. Zeit., p. 341 (1908). The Japanese form recorded by Ulmer as *L. borealis* can not be that species. He could not have examined a specimen in good condition, or he would never have considered the form identical with *borealis*, from which it is in reality quite distinct.

The wing-markings of this species vary to a remarkable extent.

Habitat—Hokkaido (Sapporo, Hokodate); Shikoku (Uwajima, prov. Iyo). Outside of Japan—China, Amurland.

Time of appearance—Unknown.

6. **Limnophilus fuscovittatus** Matsumura.

Limnophilus fuscovittatus Matsumura, Thous. Ins, Jap., I, p. 171, pl. XII, fig. 13, ♀ (1904); Matsumura, Syst. Ent. (Konchu bunruigaku), I, p. 190 (1907).

Limnophilus subfuscus Ulmer—Cat. Coll. Zool. Selys, VI (1), p. 20, figs. 32-35 (1907); Ulmer, Deutch. Ent. Zeit., p. 341 (1908).

The *L. subfuscus* described by Ulmer is apparently identical with *L. fuscovittatus*, which was overlooked by him. The original description of this species, which is not a bad one and is accompanied by a figure, cannot be considered unrecognizable, though written in the Japanese language, for the latter is certainly not to be regarded as unintelligible by the workers of the western world. I was therefore compelled to make *subfuscus* a synonym of *fuscovittatus*.

Habitat—Hondo (Tokyo and Gifu).

Time of appearance—October, April—It possibly passes winter in the imago state.

7. **Limnophilus affinis** Curtis.

Limnephilus affinis Curtis, Phil. Mag., IV, p. 123 (1834).

Limnephilus stigmaticus Kolenati var. (?) *affinis* Walker, Cat. Brit. Mus. Neuropt., I, p. 27 (1852).

Limnophilus affinis MacLachlan, Rev. Syn. Trichopt. Europ. Fauna, p. 82, pl. IX, fig. 8 (1875); Matsumura, Thous. Ins. Jap., I, p. 170, pl. XII, fig. 9, ♀ (1904); Matsumura, Journ. Coll. Agr. Tohoku Imp. Univ., IV, p. 16 (1911).

Several specimens from Sapporo (H. Okamoto coll.), Gifu (S. Yamamura coll.), Uwajima, Prov. Iyo (Arakawa coll.) are in my collection. I have compared these with others from Europe (I am indebted to Mr. E. Petersen for several European specimens of this species) without discovering any difference that appears to be specific. The Japanese form is somewhat larger and occasionally has an oblique hyaline band on the disk of the forewing.

Distribution—Japan, Saghalien, Siberia, Europe.

Time of appearance—March and April.

8. **Limnophilus amurensis** Ulmer.

Limnophilus amurensis Ulmer—Stett. Ent. Zeit., Jg. 66, p. 8, taf. I, figs. 4 and 5 (1905); Ulmer, Cat. Coll. Zool. Selys, VI (1), p. 19, figs. 28, 29, taf. I, fig. 5 (1907); Ulmer, Deutch. Ent. Zeit., p. 341 (1908).

Habitat—Hokkaido (Sapporo). Amurland.

Time of appearance—Unknown.

9. **Limnophilus ornatus** Banks (?).

Limnophilus ornatus (?) Ulmer, Cat. Coll. Zool. Selys, VI (1) p. 20, figs. 30, 31, taf. I, fig. 6 (1907); Ulmer, Deutch. Ent. Zeit., ip. 341 (1908), nec Banks.

This species is unknown to me. Ulmer recorded two female specimens from Hokkaido ("Yerse"), saying, "Die beiden Stücke stimmen gut, wie das auch meiner Figur auf Tafel I zeigt, mit der Beschreibung von Banks überein; die Appendices præanales eines amerikanischen Exemplares, das mir von C. Betten gesandt wurde (det. N. Banks) sind allerdings an der Basis etwas breiter und schwach medianwärts statt lateralwärts gekrümmt; . . . "

In any case it is very interesting to know that the same or a very closely allied species occur in such widely separated localities as North America and Hokkaido.

Genus *Nothopsyche* Banks.

10. **Nothopsyche pallipes** Banks.

Nothopsyche pallipes Banks, Proc. Ent. Soc. Wash., VII, p. 107, pl. III, fig. 1 (1906); Ulmer, Cat. Coll. Zool. Selys, VI (1) p. 29, figs. 48, 49 (1907); Ulmer, Deutch. Ent. Zeit., p. 341 (1908).

Habitat—Hondo (Gifu, and Numata, Prov. Kozuke).

Time of appearance—October.

11. **Nothopsyche ruficollis** (Ulmer).

Chilostigma ruficolle Ulmer, Stett. Ent. Zeit., Jg. 66, p. 14, taf. I, figs. 12, 13 (1905).

Nothopsyche ruficolle Banks, Proc. Ent. Soc. Wash., VII, p. 107 (1906).

Nothopsyche ruficollis Ulmer, Cat. Coll. Zool. Selys, VI (1) p. 29, figs. 46, 47 (1907); Ulmer, Deutch. Ent. Zeit., p. 342 (1908).

Habitat—Hondo (Tokyo, Gifu, Numata). Shikoku (Uwajima, Matsayama). Kiushin (Yanagawa, Prov. Chikugo).

Time of appearance—August to November.

12. **Nothopsyche longicornis,** sp. nov.

Head fuscous black; frons with long piceous hairs; maxillary palpus greyish black; antenna black, much longer than fore-wing.

Prothorax dark orange, beset with long fuscous hairs. Meso- and metathorax black or fuscous black. Legs blackish, with many black spines; spurs black.

Fore-wing broad, semi-hyaline, nearly uniformly smoky brown, somewhat suffused with yellowish in basal area; venation fuscous; discal cell very long, twice the length of the first apical cell. Hind-wing similar to the fore-wing, but the basal area not suffused with yellow; colour of the wing lightened in inner marginal area; venation darkish.

Abdomen dark brown, ochraceous toward apex; hind margin of each segment narrowly variegated with dark yellow. In the male the posterior margin of the 9th abdominal segment produced into a quadrangular prolongation in the middle; superior appendage ochraceous, stout, and broad; inferior appendage very long, stout, with the apex furnished with numerous spiny hairs; viewed from above, between the inferior appendages, are seen two slender yellowish processes.

Length of body 5—5.5 mm.; length of fore-wing 9 mm.; length of hind-wing 7 mm.

The type is a single male specimen captured by Mr. S. Yamamura at Minakuchi, Prov. Ohmi, on November 4, 1911.

This species is closely allied to *N. ruficollis*, but can at once be distinguished from the latter by the much smaller size. The structure of the male genitalia and a certain character in wing venation also afford unmistakable distinctive criteria between the two species.

Genus *Moropsyche* Banks.

13. **Moropsyche parvula** Banks.

Moropsyche parvula Banks, Proc. Ent. Soc. Wash., VII, p. 108, pl. III, figs. 3, 8 (1906); Ulmer, Deutch. Ent. Zeit., p. 342 (1908).

This species is unknown to me. I have not yet obtained a specimen, nor have I seen any in Japan.

Habitat—Kiushiu (Hikozan), according to Banks.

Time of appearance—March, according to Banks.

DESCRIPTION OF A NEW SEED CHALCID FROM SPRUCE

BY S. A. ROHWER, BUREAU OF ENTOMOLOGY, WASHINGTON, D. C.

The following new species has been reared from the seeds of Engelmann spruce (*Picea engelmanni*), from the Sitka spruce (*Picea sitchensis*), and from Colorado blue spruce (*Picea parryana*). It has been reared from seeds collected in Beulah and Glenwood Springs, Colorado; while the types come from Crescent City, California. The material has all been reared by Mr. J. M. Miller.

Megastigmus piceæ, new species.

In Marcovitch's correction to Crosby's table (Can. Ent., 1914, Vol. XLVI, p. 438) the female runs to *laricis* Marcovitch, but may be separated from that species as follows:

Propodeum with a median carina; face all yellow and without many long black hairs; cheeks yellow; flagellum yellow beneath; femora pale.....*laricis* Marcovitch.

Propodeum with two short carinæ basally; face with median brownish spot and with many long blackish hairs; cheeks black; flagellum black; femora black basally.....*piceæ* Rohwer.

The male differs from the descriptions of *lasiocarpæ* and *laricis* in a number of characters.

Female.—Length 2.5 mm.; length of the ovipositor 2 mm. Head finely rugulose with the lines radiating from the ocelli and from the mouth parts; postocellar line one-fifth longer than the ocellocular line; intraocellar line subequal with the ocelloccipital line; pronotum and mesonotum transversely aciculate, on the prescutum the aciculations are much finer anteriorly, and they are more pronounced posteriorly; axillæ granular posteriorly; scutellum reticulate, anteriorly with a tendency towards striation; stigmatal club as in Figure *1a*. Black; palpi, mandibles, face below a line slightly above the bases of the antennæ, scape and pedicel beneath, *yellow;* face medianly with longish, subcircular, brownish spot; legs yellow, with the following black or brownish markings:

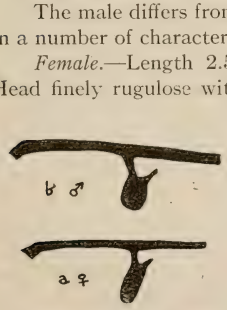

Fig. 13.—*Megastigmus piceæ*, stigmatal club.

Bases of the four anterior coxæ, the four anterior femora posteriorly and the posterior femora except apices; wings hyaline, venation brownish.

Male.—Length 2 mm. Sculpture as in the female. Black; palpi, face below a line slightly above the bases of the antennæ, posterior orbits to the height of the yellow on the face, scape and pedicel beneath, spot on the pronotum laterally, spots on the abdomen laterally on tergites three and four, *yellow;* legs yellow, coloured as in the female except tibiæ and tarsi are slightly brownish.

Crescent City, California. Described from four females, one, type, and four males, one allotype, recorded under Bureau of Entomology Number Hopk. U. S. 10850j. Material collected by P. D. Sergent and reared by J. M. Miller in April and May, 1914, from seeds of *Picea sitchensis.*

Type.—Cat. No. 19066, U. S. N. M.

THE RATE OF HATCH OF SCALE INSECT EGGS.

BY C. W. WOODWORTH, UNIVERSITY OF CALIFORNIA, BERKELEY, CAL.

Scale insects, particularly those of the sub-family Lecaninæ, are among the most prolific insects, and evidently the normal death rate will be in the neighbourhood of 99.9%, since at least a thousand eggs is the normal reproduction and males are very rare in the two commonest species.

At what point in the life history the greater part of this reduction in numbers occurs has never been investigated fully, but we have now rather extensive data upon the rate of death before hatching.

A very large series of experiments was carried on last spring upon the effect of cyanide gas, and half the eggs from each insect experimented with were kept untreated as a check. Two hundred lots of a hundred insects each were in these experiments, and, estimating 500 untreated eggs in each, the data below gives the rate of hatch determined from observations on about 10,000,000 eggs.

These studies covered five species and twelve localities, Ontario and Santa Barbara in the South, and Anderson, about 500 miles to the north, give more than the average hatch, and the

same is true of Folsom and Merced in the center of the hot interior valley. Only at Aromas, in one series of black scale on olive and European Fruit Scale on apricot, is the percentage far below the normal, but the black scale on apricot, both there and at Watsonville a few miles away, the percentage of hatch is very high.

We are led to conclude that food plant or locality has very little to do with the rate of hatching which this year averaged 87.75% for the whole series.

SCALE	PLANT	LOCALITY	NO. LOTS	HATCH
Black Scale	Apricot	Aromas	100	100 %
	"	Ontario	100	97 %
	"	Watsonville	100	76.8 %
	Grape Fruit	Santa Barbara	600	86.6 %
	Maytenus	Berkeley	100	96 %
	Olive	Aromas	100	53.6 %
	"	Folsom	300	81.1 %
	"	Merced	300	93.9 %
	Orange	Ontario	400	89.6 %
	Peach	Berkeley	300	73.2 %
	Prune	San Jose	100	100 %
	"	Lake County	100	100 %
	Total		2600	86.68%
European Fruit Scale	Apricot	Aromas	100	52.5 %
		San Jose	100	98.3 %
		Santa Barbara	100	97 %
	Prune	Santa Clara	400	95.4 %
		San Jose	3600	89.85%
		Lake County	2600	90.99%
		Aromas	100	80.6 %
		Anderson	200	100 %
	Xmas Berry	Berkeley	7200	83.67%
	Total		14400	87.41%
Oak Scale	Oak	Berkeley	400	97.92%
Pine Scale	Pine	Berkeley	1200	95.17%
Peach Scale	Ivy	San Jose	1400	83.48%
	Grand Total		20000	87.75%

University of California, December 31, 1914.

BOOK NOTICE.

INSECTS INJURIOUS TO THE HOUSEHOLD AND ANNOYING TO MAN. By Glen W. Herrick, Professor of Economic Entomology, Cornell University, New York. The McMillan Company. 470 pages, price $1.75.

Few persons realize to what extent our homes are liable to attacks by insects, though everyone may complain of those that are directly annoying to him personally. It will be somewhat of a surprise, therefore, to the average reader to learn from this book how many and how varied are the numbers and modes of attack of what may be termed domestic insects. The first hundred and fifty pages of the book are filled with the life histories and methods of control of House and Stable Flies, Mosquitoes, Bedbugs, Cockroaches and Fleas. Ants and their activities and invasions are next dealt with; then follow chapters on insects injurious to clothes and carpets, to cereals and preserved fruits, to meats, cheese and condiments; human parasites, annoying pests of man, some troublesome invaders, wood-boring insects and a chapter on insects that are poisonous and objects of dread, concluding with instructions for fumigating. The book is illustrated with 152 cuts and eight plates.

The writer has had occasion to refer to this work when replying to the enquiries of correspondents and has found it most convenient for the purpose, especially where one wishes to learn the well-tested methods of control. The lists of references to economic literature at the end of each chapter are also very useful. Those who are in charge of the entomological departments of Experiment Stations, and who are, therefore, constantly applied to for information and advice respecting insects of all kinds, will find this book a most convenient manual of reference. The ordinary householder may fail to appreciate it until his property or comfort is seriously attacked by one or more minute insect foes; when such troubles arise he will find all the information he requires in clear and plain language and full directions for waging a successful warefare against the invading enemy.

C. J. S. B.

Mailed March 10th, 1915.

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POPULAR AND ECONOMIC ENTOMOLOGY.

NOTES OF ECONOMIC INTEREST FROM BRITISH COLUMBIA.*

BY R. C. TREHERNE, AGASSIZ, B. C.

The Province of British Columbia, from the standpoint of insects of economic interest, occupies an extremely interesting position, both in regard to those insects indigenous to and acclimatised within its boundaries and because the location makes the Province liable to insect migrations from points in the Pacific.

It has been said that the British Columbia field of economic entomological investigation is the most interesting of any in the Dominion of Canada. This, of course, is not strictly true, but the great interest of the western field lies in the fact that one is able to cover the essential history of agriculture, which has occurred for the most part within the past half century, and note the appearance and progress of related-insect pests.

For instance, the Imported Cabbage worm (*Pontia rapæ* Sch.) was observed in the eastern section of the Province in 1898 and 1899. It had spread west to the Pacific Ocean in 1901, while in 1902 it had crossed the narrow strip of water and was taken on Vancouver Island. The Colorado Potato Beetle (*Leptinotarsa decemlineata* Say) became established at Nez Percé in Idaho State some 12 years ago. It now apparently infests southeastern Washington seriously and its movement is undoubtedly towards the southeastern boundary of British Columbia. As yet, we have no record of its presence in the Province. The San José Scale, however, was found at one known point in the Province some years ago,† and that in a small isolated orchard area. Through radical control measures the outbreak was checked and is now believed to be entirely eradicated, but the northern trend of this scale is being watched from the lower valley of the Okanagan River in Washington State. Two years ago it had reached a point at

*Contributions from the Entomological Branch, Department of Agriculture, Ottawa.

†1894.

the junction of the Columbia and Okanagan Rivers, but thus far has not arrived in the southern Okanagan orchards. The Codling Moth (*Cydia pomonella*) has gained access to the orchards of the Province on four or five definite occasions, each one traceable to Californian, Oregon and Ontario importations. Fortunately each of these outbreaks has been caught in its incipiency, consequently there is every reason to believe that few moths will appear in the spring of 1915. The record of the control of this insect alone constitutes an excellent example of applied economic entomology, and an account of the methods used might well find its way into the pages of this journal at some later date. This insect, however, is gradually moving up in natural stages towards the boundary line from the South, the nearest record being at a point midway between the junction of the two rivers before mentioned and the Okanagan boundary line. The Woolly Aphis (*Eriosoma lanigera*) is one of the most injurious insects in the Province, especially on the immediate Pacific Coast region, but there is good reason to believe its numbers were quite negligible about the year 1893. And this is much the case with most of the farm and orchard insects of the Province.

Horticulture is at present the "first arm" of the agricultural interests of the Province, and it is interesting to note that the Provincial Horticulturist, Mr. R. M. Winslow, has stated that the "census of 1890 showed 6,000 acres of fruit, the census of 1900 an increase to only 8,000. At the time of the 1910 census the acreage had increased to 33,606, and the survey of 1913 showed this further increased to 38,196 acres."

These facts, therefore, clearly indicate an original condition and establishes the point that the chief interest of economic entomology in British Columbia lies in one's ability to observe the growth of the agricultural industry in connection with the development of attendant insect pests.

While forest and range insects are not being referred to in this article, for the reason that they represent an entirely different problem, it is interesting to note that not the least important of the insect troubles of the orchard and farm are derived primarily from the virgin lands, which, as the above rapid growth of cleared land would indicate, are gradually being broken up to give place

to cultivated crops. It may be rightly assumed that such insects are worst pests to the agriculturist in the years immediately following the destruction of their native host plants. Eventually, it is hoped, their attacks will decrease for the reason that the food plant may not be entirely suitable. We may place the following insects in this category.

The Fruit Tree Leaf Syneta (*Syneta albida* Lec), which is believed to to have fed originally on the wild species of willow, now freely attacks blossoms and leaves of fruit trees and is reported as doing damage to strawberries and clover. The Bronze Apple Tree Weevil (*Magdalis œnescens*) formerly no doubt, infested dying twigs of forest trees, but now is recognized as an apple-infesting insect frequently met with in neglected orchards. It causes a series of minute punctures closely congregated on injured twigs and branches. Several species of Eleodes are recorded, notably *pimelioides*, *obscura*, *humeralis*, *hispilabris*, and some have been observed infesting potatoes. The genus *Otiorhynchus* represented by the species *sulcatus*, *ovatus*, and probably *rugifrons*, are in all probability primarily grass-infesting insects, but, in this latitude, are among the most important of the insect pests injurious to gardens, greenhouses and small fruit plantations. There are, again, at least twenty species of Click-beetles (*Elateridæ*) recorded at present for the Province, and while the larval (wireworm) stage is universally recognized as a serious nuisance to pasture land, the adults have shown themselves to be of economic importance to fruit growers by their attacks on blossoms and buds of fruit trees in the spring. Seven and eight-year old apple trees have been observed to be entirely denuded of bloom by the adults clustering on the flowers and devouring the pistils, stamens and calyces. Fruit on the tree will also be attacked in midsummer as will the leaves.

Ants are also shown to be enemies to the fruit grower. To Mr. W. H. Brittain (at present Provincial Entomologist for Nova Scotia, formerly of British Columbia) belongs the credit for first drawing attention to the injuries of blossoms by ants. Further observations which have been made lately have shown the correctness of Mr. Brittain's findings. The species *Formica rufa* subsp. *obscuripes* is alone, as yet, recorded in this form of injury. The

blossoms of peach, pear, apple and cherry are attacked and the settings of fruit totally destroyed. Those trees in the orchard immediately adjoining rough land suffer most, it would appear, for in such uncultivated places the nests of the species may be found. It is particularly interesting to note that no aphids exist on the trees at the time the fruit is in bloom, consequently the nectar remains the sole attraction. Later in the summer the ants attend the aphids of the Cottonwood poplars. Certain *Tischeria* Leaf-miners of the apple are noticeably worse in orchards near the timber line, and certain Bud Weevils are adopting fruit trees as hosts following the destruction of their own food plants. Slugs, while not insects, are animals very commonly found in the moist alluvial soil of the Lower Fraser Valley, and may frequently be observed under decaying leaves and vegetation in the "bush." Injury has been observed to young corn (maize) plantations in the spring by these animals and their presence is indicated by the peculiar slimy remains about the plants and the "shredding" of the young tender leaf shoots.

Most of these insects mentioned, it will be seen, are especially related to the forest or virgin lands of the Province, and this relation constitutes a remarkably interesting phase of the study of economic entomology in the West. The majority of the more important orchards pests of British Columbia are identical with those in other Provinces of the Dominion, and their life histories are very similar only in some cases slight variations occur owing to differences in climatic conditions. But as these variations take place within the Province itself, specific insects will, it is hoped, be dealt with on subsequent occasions.

LIFE HISTORIES OF NORTH AMERICAN TINEINA.

BY ANNETTE F. BRAUN, CINCINNATI, O.

Choreutis inflatella Clemens.

Brenthia inflatella Clem., Proc. Ent. Soc. Phil., II, 5, 1863; Tin. No. Am., 209, 1872.

Var. *virginiella* Clem., Proc. Ent. Soc. Phil., III, 505, 1864; Tin. No. Am., 257, 1872.

Choreutis inflatella, var. *virginiella*, Dyar, List N. A. Lep.,

No. 5519a; Kearf., Jn. N. Y. Ent. Soc., X, 111, 1902; Busck, Proc. Ent. Soc. Wash., V, 219, 1903.*

The larvæ of this species were found in great numbers feeding on leaves of *Scutellaria lateriflora* L., a plant which grows commonly on low-lying grounds around Cincinnati. A slight web is spun on the upper side of a leaf, causing the margins to approach. Within this folded leaf the larva feeds, picking out the substance here and there, but usually leaving the lower epidermis intact. Toward the top of the plant, where the leaves are small, several are drawn together. The cocoon is spun within a fold of a leaf, which has, as a rule, not been previously attacked by the larva. It resembles the cocoon of other species of the genus.

The larvæ, which were nearly full-grown when collected, September 9, yielded imagos from Sept. 21 to 28. The entire series, some 18 or 20 specimens, represent the varietal or more common form of the species, in which all the metallic scales are violet-coloured.

Aristotelia salicifungiella Clemens.

Gelechia salicifungiella, Clem., Proc. Ent. Soc. Phil., III, 508, 1864; Tin. No. Am., 262, 1872.

Aristotelia salicifungiella Busck, Proc. U. S. N. M., XXV, 798, 933, 1903; Proc. Ent. Soc. Wash., V, 220, 1903; Dyar. List N. A. Lep., No. 5599, 1, 1902.

This species has several times been recorded as bred from cecidomyid galls on willow, but without definite observations on its larval habits. I have bred a number of specimens from larvæ feeding on leaves of *Salix longifolia*, the original food plant. The larva stretches a very loose irregular network of silken threads between the leaves of the terminal or lateral shoots, but does not draw the leaves together. It feeds within, eating portions of the leaves. Pupation takes place (in the breeding jar) either between two leaves or amongst the debris in the bottom of the glass. The cocoon is spun of silk and particles of earth. Larvæ taken July 6, varying from very small to nearly full grown, produced imagos from July 29 to August 7.

Larva: Head pale straw coloured; body pale green, with a

*Only the reference to the original description, and references to papers subsequent to Dyar's List are given. For other references, see Dyar's List.

number of very fine, somewhat broken, faint blackish lines along the back and sides.

It would seem that the original association of the larva with cecidomyid galls was merely accidental, due to the frequency of the occurrence of these galls on this species of willow, from which, in this case, remarkably enough, they were almost entirely absent.

The ornamentation of all the bred specimens is very constant, and the brick-red colour easily distinguishes them from their nearest ally, *A. fungivorella* Clem.

Recurvaria dorsivittella Zeller.

Gelechia dorsivittella Zeller, Verh. zool.-bot. Ges. Wien, XXIII, 267, 1873.

Recurvaria dorsivittella Busck, Proc. U. S. N. M., XXV, 813, 1903; Dyar, List N. A. Lep., No. 5603, 1902.

The larva feeds on sweet gum (*Liquidambar styraciflua* L.) and is common in Clermont County, O., where the sweet gum forms a large part of the forest over the flat, undrained areas.

A tube of brownish silk and frass, about 1 cm. long, with a diameter of about 1 mm., is spun along a vein on the underside of a leaf. The tube is open at both ends, but at each end the free side projects slightly over the opening. Along the sides of the tube, and around each end, the larva eats irregular patches of leaf substance, leaving the upper epidermis and veins; gradually it feeds farther from the opening of the tube. When found during the later larval stages, the leaf, near the vein, where the tube is attached, is usually perforated with irregular holes, due doubtless to disintegration of the epidermis where the underneath part of the leaf was consumed during the early larval period.

At pupation, the ends of the tube are closed.

The larvæ were collected August 27 and continued to feed for a couple of weeks. Imagos in May of the following year.

Elachista prælineata, n. sp.

Face gray, shining; head blackish behind. Palpi fuscous beneath, paler above; terminal segment with its tip and a broad band in the middle fuscous. Antennæ blackish with paler annulations; last one or two segments pale.

Thorax black, with a few scales at its posterior end, and at the tip of the patagia white. Fore wings black; base white with a faint yellow tinge; a slightly curved narrow white fascia at 2-5, about equally distant from the base on either margin; at 4-5, a triangular white costal spot, whose inner edge is almost on a line with the inner edge of a similar dorsal spot, placed a little nearer the base. Cilia around the apex white, elsewhere concolorous with wing.

Legs black, silvery on their inner sides, tarsal segments tipped with white. Hind tibiæ with a spot in the middle and the apex conspicuously white.

Expanse: 6.5–7.5 mm.

Eight specimens, Cincinnati, O., August 2–8.

Occasionally, especially in males, the fascia and pair of spots are very narrow, but still distinctly defined.

The larva is a miner in leaves of *Hystrix patula* Moench., a common tall grass in dry hillside woods. The mine starts as a narrow line, scarcely visible on the upper side, and gradually enlarges into a blotch, with its greatest width 4 or 5 mm. Except in the wider portions of the blotch, the parenchyma near the lower side only is consumed; even in the broadest part of the blotch some of the parenchyma near the upper epidermis is left, giving the mine a speckled and greener appearance on the upper side, so that the mine is more distinctly visible on the lower surface where the epidermis is whitish. Pupa enclosed in a few criss-cross silken threads. At the time the larvæ were collected, July 18, many of the mines were deserted.

Theisoa constrictella Zeller.

Oecophora constrictella Zeller, Verh. zool.-bot. Ges. Wien, XXIII, 291, 1873.

Theisoa constrictella, Dyar, List N. A. Lep., No. 6130, 1902.

The larva feeds under a web on the lower surface of leaves of white elm (*Ulmus americana* L.) and cork elm (*Ulmus racemosa* Thomas). A whitish silken tube crosses from the base of the petiole to the underside of the leaf, but is not attached to the petiole except at the base. From the mouth of this tube a thin web spreads over the basal part of the leaf; gradually covering more and more of the breadth of the leaf as the tube is lengthened.

The web is, however, in large part confined to the half of the leaf upon which the tube opens. The tube is of but little greater density than the web and is chiefly defined by the frass which collects along its sides.

The cocoon is a thin oval silken affair, spun between two leaves or on the ground, and is very similar to that of the species of *Chrysopeleia*.

The larvæ from which the above notes were made were collected July 3 near Cincinnati; one imago appeared July 30. A later generation of larvæ produces the imagos which appear in May of the following year.

Psacaphora engelella Busck.

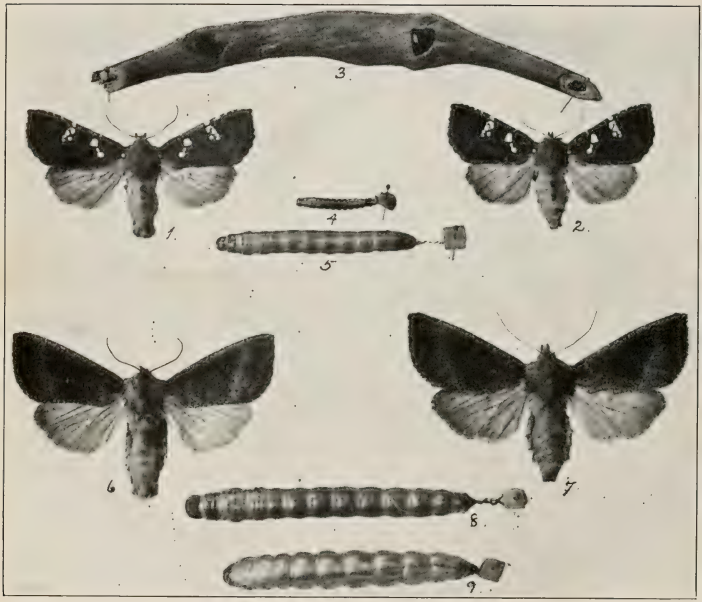
Psacaphora terminella Westw.

? Syn. *Mompha engelella* Busck, Can. Ent., XXXVIII, 123, 1906; Proc. Ent. Soc. Wash., XI, 96, 1909.

At the time of describing *Psacaphora* (*Mompha*) *engelella*, Mr. Busck noted its very close resemblance to *Psacaphora* (*Mompha*) *terminella* Westw. of Europe. I have succeeded in rearing a number of specimens, and the life history is identical with that of the European *P. terminella*. The larva mines leaves of *Circaea lutetiana* L. The earliest mine is a narrow thread-like, sometimes spiral, tract, which abruptly enlarges into a small blotch. Several successive blotches are formed, the last occupying almost half of one of the larger leaves. The mines were collected July 3. At this time many of the larvæ were full grown and ready to leave the mines preparatory to pupation. The cocoon is yellowish, flattened, tapering at the posterior end, broadly rounded at the anterior end where the two sides form a lip-like opening to admit of the emergence of the adult. Imagos emerged July 22-27.

These bred specimens agree in all respects with a number of flown specimens in my collection from one of the type localities (Pittsburg). As would be expected, the golden colour of the bred specimens is a little deeper—more orange—and the metallic margining of the basal black blotch is more conspicuous.

Although I have no specimens of the European *P. terminella* for comparison, the fact that the descriptions are practically the same, and that the food plant is native both to Europe and North America, strongly support the synonymy suggested above.



PAPAIPEMA HUMULI (1-5).

P. SILPHII (6-8).

P. MARITIMA (9).

(See p. 115).

NEW SPECIES AND HISTORIES IN PAPAIPEMA SM. (LEPIDOPTERA.)

BY HENRY BIRD, RYE, N. Y.

(Continued from Vol. XLVI, p. 73.)

Recent investigations of the Papaipema fauna in the vicinity of Chicago, Ill., has brought to light, among other things, the prevalence of an undetermined species, a representative of the Central States. More success attaches to this, since instead of a chance happening on an imago, a well directed search of the more indigenous plants disclosed the larva, and put the additional evidence of the early stages at our disposal. After moths were reared, it was seen to be a form that had been taken occasionally in former years, but identified as *P. necopina* Grt., and so distributed in a few instances by the local collectors. But the departures in the larval and pupal stages as well as the apparent difference in the imago, when a fresh series is at hand, produce a sum of evidence prohibiting its association with any described form.

To the efforts of Messrs. A. Kwiat and E. Beer, whose early studies in these life-histories are thus encouragingly rewarded, we are indebted for this fine disclosure, whereby one of our largest *Papaipema* species has its individuality proclaimed. Very generously they have placed their material and data in our hands for treatment.

In our early correspondence it was suggested that special attention be given to indigenous and primitive prairie plants in the effort to locate larva, the writer's hopes of conducting such investigations personally, failing of realization up to the present. The new form is found working in *Silphium*, principally *S. terebinthinaceum*, but in some extent in *S. perfoliatum* and *S. laciniatum* also, while in one instance a pupa from *Arctium* indicates an alternative occupancy of this cosmopolitan substitute, which happens so frequently in suburban borders. Believing the preferred foodplant to be restricted to the genus *Silphium*, which seems more or less a prairie type, we beg to propose the following name:

Papaipema silphii, n. sp.

Ground colour smoky umber brown with whitish to purplish grey powderings on thorax and primaries. Head and vestiture of thorax show ground colour deeply, the long scales tipped white and the border of collar often so defined; antennæ of male heaviest and show minute ciliations, no conspicuous white scales at their bases; anterior thoracic tuft prominent but not broadened out laterally so much as usual. Fore wing of similar hue and of almost even tone throughout, the median space the darkest, the ante- and post-medial areas tinted with a faint lilac or mauve reflection in most cases, but contrasts are minute; the post medial line is rather straight in its oblique course after turning past the cell and but faintly indicated usually, sometimes, especially near the hind margin, it becomes conspicuous in a fasciate sprinkling of white scales; subterminal line rarely shown as a simple marking of lunulate whitish scales, excurved centrally; the central portion of the reniform is sometimes indicated as a blackish shade, or it may be illuminated by lighter scales of the ground colour, but generally the stigmata may be said to be practically obsolete; at the outer margin a minute white dot may mark the extremity of the veins, and on the costa, outwardly from the inception of the post medial line, four prominent white dots usually occur. Secondaries paler, suffused in the deeper smoky tone at the outer margin; veins darkly marked in similar hue. Expanse 40 to 50 mm.

The male genitalia are of the usual generic type, but more heavily chitinized and larger than common, the valves broader than with the allies, the clasper or harpe (Pierce 1914) is toothed but slightly on the outer side, the clavus an elevated ridge densely clothed with short pile-like hair.

Habitat.—The suburban environs of the city of Chicago, Ill., and undoubtedly following the foodplant generally through the Central States. The male specimen marked *type* with the author bears the label Cicero, Ill. Twenty-five examples are under examination. Paratypes are with Messrs. Kwiat and Beer, and one will be placed in the United States National Museum. Emergence dates for the series bred are Sept. 17 to Oct. 4.

Silphii has broad primaries, is larger than its associates, *necopina*, *duplicata*, *nebris* and *maritima*, being nearest the latter

in general appearance, but browner and easily separated when fresh. Some variation exists, but it is not pronounced, and old specimens seem to fade to an even, sordid brown tone.

On larval observations the following is gathered from correspondence with Mr. Kwiat. In *S. terebinthinaceum* the larva enters before the principal flowering stem has arisen, working usually down through the lower stems of some subsidiary growth, and soon is in the root where it tunnels rather extensively about. In old established plants the fleshy roots become tough and spreading, and such are the more likely to be infested. "These roots are certainly immense. We took up some which were fully a foot in diameter, and eight or ten inches deep in the ground. In turning up such roots, we found one pupa and five larvæ ready to pupate. These were under the root, and we observed that they eat through the root into the soil for pupation. The proper time therefore to get the species is July 15 to 25." Arriving at maturity at this date would indicate the hatching period to be about the middle of May. While parasitism was not observed in the later stages, a fungous disease, however, claimed many.

The associated insect fauna of these *Silphium* root clumps is of interest. Mention need only be made of *Hydroecia immanis* Gn. as a decidedly unexpected occurrence, and of a curious dipteron, an Ortalid which seems to be new. Thus *immanis* makes a radical departure in this selection, as against the root crown of Hop, in which it has so long been known to operate throughout the East. The fact of the alternative food plant becomes of some economic import, since it permits *immanis* to flourish where Hop might not grow, and opens the question of a primitive food plant for this species. It seems strange that plants so far removed in botanical systematisations should both appeal to the taste of an insect so discriminating as this one has proved to be in the past. Our correspondents inform us they failed to encounter Hop in their local observations so far.

The following brief characterization may sufficiently place the larva.

Penultimate stage: Generically typical; head large, brown, a black line at ocelli, plates heavily chitinized, the cephalic wide

as head and margined laterally with black border; body colour a sordid pinkish hue, the usual lines drawn in pale yellowish, the dorsal entire, the subdorsal broken on joints four to eight; tubercles well shown, brown, IVa wanting on joint ten.

Maturity: Similar, but much more robust; the lines more prominent than usual for the stage; tubercles of increased size and prominence, on joint ten there is faint indication of a plate at IVa, this feature being likely variable and on eleven I and II very large. Length 47 and 52 mm. for the stages respectively.

The pupa is robust, having a dark shell like *nebris*, a slight swelling occurs at the anterior tuft but it is not produced with the prominence attained in *maritima*; 28 mm. long by 9.5 mm. wide.

The pupal period seems rather longer than usual; it may average fifty days.

In 1899, when the late Prof. J. B. Smith published a Revision of *Hydroecia*, among material loaned by the writer for study, two specimens returned labelled *H. circumlucens* Sm., a new specific name proposed at that time. One, a pale yellow and much worn example, was in addition marked "female co-type." The fresher, browner specimen was later discovered in the larval stage boring in the vine of the Hop, and its life history was published in 1907, Can. Ent., XXXIX, p. 137, as that of "*circumlucens*." As the years proceed and a large number are reared, it is seen there is no variation to the yellow, "co-type" form, and we are early convinced two distinct species are involved. But as this "co-type" was a flown, Rye example, it was deemed advisable to await the discovery of its larva and the better acquaintance thus offered, before calling attention to the matter. Now, after ten years, this has come about and supposition fully confirmed.

In 1908, however, Dr. H. G. Dyar recognizes the Hop vine borer to be distinct from the *circumlucens* in the U. S. National Museum collection, and in writing of the group at that time (Can. Ent. XL, p. 78), considers it to be properly the *marginidens* of Guenée, but such an association has been declared erroneous by Hampson in his studies of the group in 1910. Without entering the details, but accepting the later findings, it is sufficient to state that our Hop vine borer is without a name.

In our rather extended observations on the species we have everywhere found it associated with *Humulus lupulus*, where conditions were at all favorable for the species to gain a foothold, and we wish to propose as a name:

Papaipema humuli, n. sp.

Ground colour a rather even brick-red brown. Head and thorax shaded purplish, the base of the antenna encircled by a cluster of white scales; the tufts on thorax and abdomen specially prominent in both sexes, the anterior one above collar wide-tipped and spreading. Fore wing almost without contrasts, excepting the white stigmata; basal area concolorous, median field similar, the postmedial area narrow, tinted purplish, a yellow shading near apex; antemedial line indistinct, postmedial line double, curving out broadly past reniform, subterminal faint and very irregular; a conspicuous white scale at extreme base of wing, also along the costa above the stigmata and near the tip, several whitish dots occur; the orbicular and claviform are brightly white, superimposed as usual, the central spot much the smaller; reniform narrow, but made up of broken pure white spots collected around the central, yellow, lunulate line; fringes purplish dentate. Hind wings paler, silken, yellowish rufous with dull purplish shading at the terminal area, above which a medial line is indicated. The abdomen is of similar hue. Expanse 30 to 38 mm. The male genitalia are generically typical and show little individuality; the trigonate costa is not deeply indented on the outer margin, the anal angle much produced and at a right angle with the axis of the valva; the clasper proportionately large and heavily toothed.

Habitat: Eastern United States, southeastern Canada; New Brighton, Pa., Wilmington, Del., West Chester Co., N. Y.; Cartwright, Manitoba; type locality, Rye, New York.

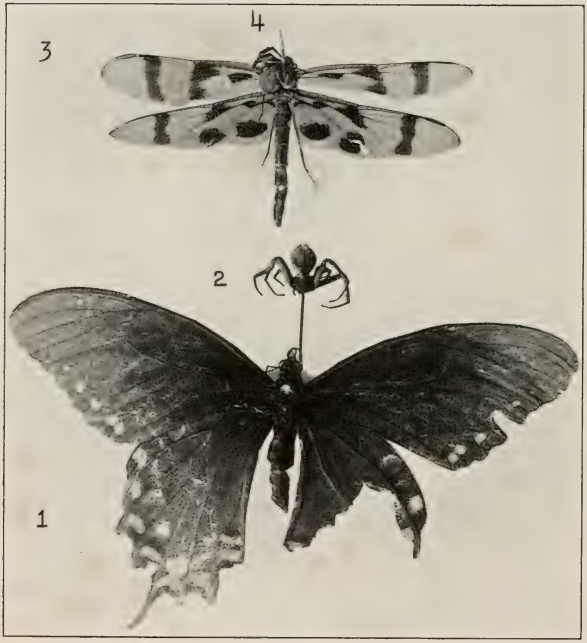
Thirty bred specimens are at hand, the type with the author, paratypes will be placed in the United States National and the British Museums and in other American collections, rectifying as far as possible the wrong determination of the species as disseminated from Rye.

The species seems closest superficially to *marginidens* Gn.,

but the stigmata are not so large, and the basal area is never white, while there is much difference in the genitalia of these two.

The larva belongs to that group having only the dorsal line entire, and has been discussed in the paper referred to. The characteristic gall produced in the stem of the vine seems always to furnish a restricted food supply, except when very large vines are chosen. But one gall is made as it is impossible for a larva to re-establish itself a second time due very shortly to their increased size, and some seem to perish from the gall becoming too small to shelter them, or upon splitting open adversely. Parasitism does not appear to be pronounced, but the insect fauna of these galls is always noticeable. The larvæ of several small dipterous species flourish in the chewed fragments and frass, especially in deserted galls, and the imago of a deltoid moth, *Palthis asopialis* Gn. has several times been reared from a larva feeding upon and having pupated within a gall. It seems improbable this common species is dependent on *humuli* galls for food supply, but that its association with Hop may be along more usual lines. The Cecidomyid, *Lasioptera humulicaulis* Felt, produces a similar gall, at times very much larger, up to 50 cm. in length, and frequently on the same stem with *humuli*. Even then the vine manages to thrive very well.

Since the association of a particular food plant is so noticeable with most *Papaipema* species, and may have had much to do in helping fix specific modifications, it seems reasonable to assume these associations date back remotely. It is true some Old World plants may serve as a substitute for this North American genus, *Arctium* meeting the cosmopolitan taste most conspicuously, but in nearly every case an indigenous, preferred food plant is very apparent. So that in advancing a name at this time we consider the Hop as indigenous, notwithstanding some botanists have designated it as introduced. The insect fauna of *Humulus lupulus* is a very considerable one and seems a fact worthy of weight. That such a large number of species subsist on it would not be likely if introduction had occurred since pre-Columbian times. We note Britton and Brown in Illustrated Flora, 1913, cite the plant as widely distr buted throughout the north temperate zone.



Papilio asterias (1) captured by *Misumena vatia* (2).
Celithemis eponina (3) killed by *M. vatia* (4).

The Japanese Hop, *H. japonicus*, clearly an introduction, yet escaped to some extent, is notoriously free from insect attack. Where doubt may arise over the question of a plant being indigenous or not, some evidence should be adduced from its insect associations.

Explanation of Plate I.

Fig. 1—*Papaipema humuli*, male.

Fig. 2—*Papaipema humuli*, female.

Fig. 3—Gall produced in Hop vine by larva.

Fig. 4—*Papaipema humuli*, larva, stage III.

Fig. 5—*Papaipema humuli*, larva, last stage.

Fig. 6—*Papaipema silphii*, male.

Fig. 7—*Papaipema silphii*, female.

Fig. 8—*Papaipema silphii*, larva, last stage.

Fig. 9—*Papaipema maritima*, larva, last stage.

INSECTS CAPTURED BY THE THOMISIDÆ.

BY JOHN H. LOVELL, WALDOBORO, MAINE.

The Thomisidæ, or crab spiders, have acquired the habit of frequenting flowers for the purpose of preying on the insect visitors. They usually lurk in thyrsoid or dense clusters of small flowers, like the inflorescence of the sumac (*Rhus*), meadow sweet (*Spiræa salicifolia*), elderberry (*Sambucus*), Viburnum, Cornus, and the bristly sarsaparilla (*Aralia hispida*), although they are also found on large individual flowers as the rose. The commonest species of this family is *Misumena vatia*, a white spider with a crimson stripe on each side of the abdomen (Pl. II). It is quite common, but its colour will often cause it to be overlooked until a dead insect is noticed lying upon the surface of the inflorescence. Mr. J. H. Emerton informs me that this species and also *M. aletaria* may be either white or yellow, and the pink stripes on the sides of *M. vatia* may be either present or absent. Another species (*M.*

asperata), he further states, has red markings, and sometimes resembles exactly the sorrel (*Rumex acetosella*).

Misumena does not spin a web, but conceals itself among the flowers and pounces upon its unsuspecting prey while it is collecting pollen or nectar. On the 16th of July I had the opportunity to observe the capture of a bumblebee gathering pollen on a wild rose (*Rosa lucida*). My attention was a moment diverted, but was again recalled by the loud buzzing of the bee. The spider had leaped upon its back and grasped it with its mandibles just behind the head. At first the bumblebee struggled violently, but so virulent was the poison that its movements speedily ceased entirely. The spider then dragged it over the edge of the flower to the leaves beneath, where it dined at leisure.

The temerity and success with which the Thomisidæ attack large butterflies or dragonflies, or stinging insects, as wasps, bumblebees and honey-bees, is astonishing. Honey-bees are often captured, and large flies belonging to the genera *Archytas* and *Therioplectes* and rarely the wasp *Vespa germanica*. In one case I observed that a small butterfly (*Melitæa tharos*) had been taken. From Framingham, Mass., I have received from Mr. C. A. Frost a number of very interesting specimens together in each instance with the spider by which it was killed. The dragonfly *Celithemis eponina*, the large butterfly *Papilio asterias* and the smaller species *Colias philodice* were captured by *Misumena vatia* (Pl. II); and the fly *Desmometopa latipes*, the wasp *Vespa germanica* and the copper butterfly *Chrysophanus americanus* by *M. aletaria*. It is difficult to understand why the spiders were not carried away by such strong-winged insects as the dragonfly and the large butterfly *Papilio asterias*, which so greatly surpass them in size and strength.

The habit of resorting to flowers to capture anthophilous insects and the protective resemblance of coloration must have been acquired by the Thomisidæ in comparatively recent times—that is, since the evolution of flowers and the development of anthophily among insects. The new habit would seem to be the result of observation and experience.

For the determination of the species of *Misumena* I am indebted to Mr. J. H. Emerton.

NOTES ON *ITHYTRICHIA CONFUSA* MORTON.*

BY J. T. LLOYD, ITHACA, N. Y.

To the family Hydroptilidæ, the most minute of all Trichoptera, belong the most oddly formed larvæ of the order. *Ithytrichia lamellaris*, of Europe, with flat form and laterally extended abdominal segments, and the more common types with swollen abdomens are noticeable departures from the usual cylindrical form of Trichopterous larvæ. The species under discussion, *Ithytrichia confusa* Morton, kindly determined for me by Mr. Kenneth Morton, belongs to the class with swollen abdomens, but carries the peculiarity to the greatest extreme. So much enlarged is the abdomen that the creature, if removed from its case and placed on its back, is unable to aright itself, and only under the most favourable conditions of still water can it, with its comparatively feeble thorax and legs, drag its great abdomen slowly about. In spite of its helplessness when removed from its case, the specialized case-building habits of the species adapt it to life in swift water. Its habits and life-history are described more in detail on the following pages.

Habitat.—In December, 1911, my attention was called to small ovals of silk which were abundant, tightly cemented to rocks in swift water of Cascadilla Creek on the Cornell Campus. Examination proved that these cases contained the peculiar larvæ which later proved to be *I. confusa*. At the time of their discovery the cases were all securely fastened to the stones, occurring, apparently, in equal abundance on top, sides, and, when space allowed, on the bottoms of their supports. At this time the creek was at its winter level, which it had assumed two or three months earlier, with the coming of the fall rains. The water was several inches higher than its usual summer level, when rocks and boulders everywhere protrude from the surface and one can almost step across its breadth. In spite of the facts that the water was much higher than when the eggs were deposited (the adults emerge in May) and that the cases, as we know them, are not portable, they were often found at slight depth, on rocks that had previously been completely above water and exposed to the intense glare of

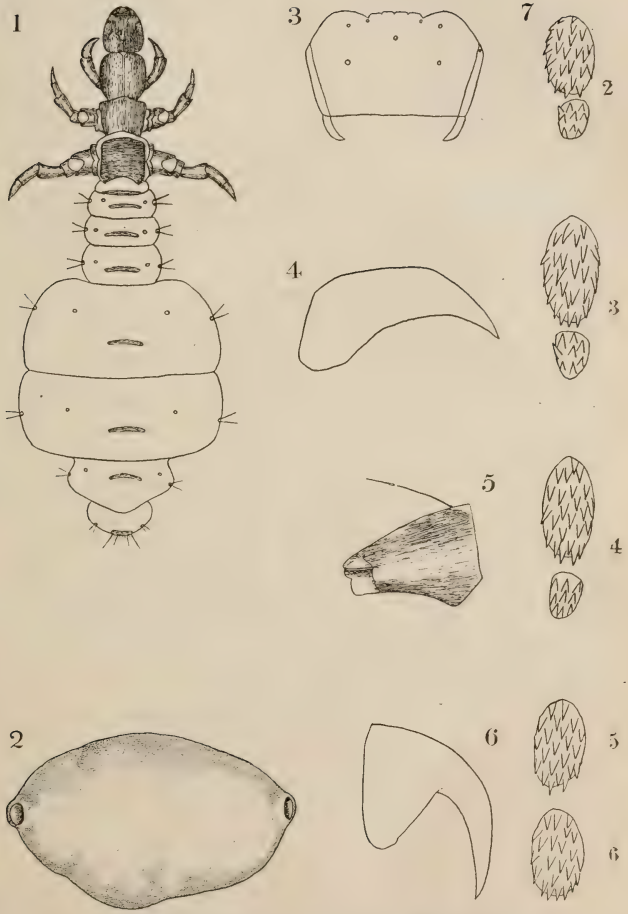
*Contribution from the Limnological Laboratory of the Department of Entomology in Cornell University.

the summer sun. Later, when the creek went down in the spring, hundreds of larvæ were unable to follow the receding water and perished of desiccation. Though we do not know the early larval stages, the facts accounted indicate that its form and habits and case must be very different from those of the mature larva. The sluggish form that is known is incapable of locomotion, and the case, with open bottom and tightly cemented periphery, is incapable of transportation, even in following the few inches of fluctuation of the creek. Yet some get to levels which during their early life were exposed to the air; then perish because evident later modifications make them unable to follow the receding water.

Not only do many larvæ die on account of desiccation, but in the spring quantities of larvæ, as well as pupæ, also perish from some other cause. Until the latter part of April the larvæ all seemed healthy; then great numbers of them died and decomposed in their cases. On the 1st of May 132 cases were examined. Of these 15 contained living larvæ, 9 cases were empty and 108 contained Chironomid larvæ. Apparently the Chironomids, the most abundant insects in the stream, had found the cases already empty or occupied only by the corpses of their previous occupants. It seems probable that this high mortality was brought about by the spring growth of algæ and deposits of silt smothering the Trichoptera to death, for larvæ and pupæ on the clean under surfaces of rocks, or in places free from deposits, lived to reach maturity.

In the spring of 1914 there were very few *I. confusa* in the stream—indeed, the entire Trichoptera population of all species was far below its normal numbers.

Larval Case.—The larval case, fig. 2, is from 5—6 mm. long and 2½—3 mm. wide. Its height above its support is barely enough to accommodate its occupant. In breadth, however, the occupant is more than amply provided for, having an abundance of room to turn around while completely within its case. At each end of the case there is a circular opening not exceeding ½ mm. in diameter. These openings sometimes are at the ends of short tubular projections of the case. In structure the upper surface of the case is composed entirely of closely woven silk cemented tightly along the edges to its support. There is no floor between the larva and the rock.



ITHYTRICHIA CONFUSA MORTON.

Larval habits.—Within its case, with openings less than ½ mm. in diameter, the larva, fig. 1, measuring three mm. in breadth at its 5th abdominal segment, is held a prisoner, unable to move from place to place or to escape. In the stream we were never able to detect any activity on the part of the larvae, nor to see any part of its protruding from its case. In the laboratory, however, though the larvæ remained concealed within their cases during the day, they fed actively at night, protruding the long thorax and first four abdominal segments from one opening of the case, swinging them slowly from side to side while scraping the rock with their mandibles; then withdrawing into the case, only to appear and repeat the procedure from the other end.

When at rest in the case, the long neck-like thorax and abdominal segments are looped back, reaching to about the caudal extreme of the abdomen.

Larval Food.—The stomachs examined contained the algæ, mostly diatoms, which form the ooze on the rocks where the larvæ live—Meridion, Gomphonema, Synedra, etc., and a few undeterminable fragments of Chlorophyceæ.

Pupal Habits.—In preparation for pupation the larva plugs the openings of its case with thick, unperforated, silk, and between itself and the rock spins a thin loose maze of silken threads. The first pupæ appeared about the first of May, and by the 12th of May almost all had pupated, though a few prepupa still remained. On May 21st two adults emerged in captivity. When emerging the pupa cuts a jagged, irregular hole in the top, near one end, of the case through which it escapes.

Description of Larva and Pupa.

Larva.—Length 5 mm. Breadth of 3rd thoracic segment ½ mm., 5th and 6th abdominal segments 3 mm. each. Colour of fleshy portions in life, brilliant bluish green, except the two swollen segments, which are duller. The colour is apparently due to fat within the body, which shows through the body-wall in irregular masses, giving an uneven coloration when viewed through the microscope.

Head.—Heavily chitinized and uniformly dark brown, except the labium and maxillæ and an ill-defined ring around each eye, which are lighter. The frons, as an area, shows rather distinctly

in intense light but its suture, even in caustic potash mounts, is not apparent.

Thorax.—A heavy chitinous plate on the dorsal side of each segment and a narrow semicircular piece of heavy chitin above each coxa; the ventral surface is weakly chitinized; the legs are robust and heavily chitinized; there is a well-developed tooth at the base of each tarsal claw.

Abdomen.—A chitinous plate, fig. 1, on the dorsum of each segment, the plate on the first segment is broader than those of the succeeding segments, the plate on the last segment (not apparent in the illustration due to the curling of the abdomen) covers the entire top of the segment, extending shelf-like over the last segment, each plate is armed with several small setæ; the 5th segment has a collar-like projection to which the 4th segment is joined, this projection may be telescoped, as in fig 1, or protruded, in the latter position it may easily be mistaken for a distinct segment, but may be distinguished by the absence of a chitinous plate; on each side of the median line on each segment except the last two and apparently the first there is a small circular spot bearing two setæ, a similar spot occurs on each side of the same segments, and also on the next to the last segment.

Pupa.—Length 3½ mm.; the antennæ extend back to the caudal margin of the 3rd abdominal segment; each mandible (fig. 4) is connected on its outer margin by two chitinous rods which run obliquely back toward the eye; behind the base of each antennæ there is a semicircular brown mark; the first two thoracic segments bear plate-like marks above; the third thoracic and 1st abdominal segments are marked dorsally by a few narrow, apparently chitinous, lines; the last segment lacks appendages.

Explanation of Plate III.

Fig. 1—*Ithytrichia confusa*, larva, dorsum.
Fig. 2—*Ithytrichia confusa*, larva, case.
Fig. 3—*Ithytrichia confusa*, larva, labrum.
Fig. 4—*Ithytrichia confusa*, pupa, mandible.
Fig. 5—*Ithytrichia confusa*, larva, mandible.
Fig. 6—*Ithytrichia confusa*, larva, drag-hook.
Fig. 7—*Ithytrichia confusa*, pupa, chitinous plates of abdomen.

FURTHER NOTES ON ALBERTA LEPIDOPTERA.

BY F. H. WOLLEY DOD, MIDNAPORE, ALTA.

(Continued from Page 42.)

635. **Mamestra carbonifera** Hamps.—(Can. Ent. XL, 104, March, 1908, Miselia.) Described from two females taken on Wilcox Pass, Alberta Rockies in 1907, by Mrs. Nicholl. I have a female in my collection taken at treacle on Pine Creek on July 4th, 1904. Mr. Sanson has taken it at Banff on several occasions, having shown me four males, dated July 25th, 1911, or prior, and July 1st and 13th, 1914. It might be taken for a melanic form of *imbrifera*, but lacks the ochreous tints of that species, and has more hairy thoracic vestiture. The male antennæ are minutely serrate-fasciculate, exactly as in *discalis*, with the addition of a short bristle, shorter than in *imbrifera*. Hampson finds *Miselia* Ochs. a prior name for *Polia* Ochs., to which he refers most of our species known under *Mamestra*.

A close ally of this species is *leomegra* Smith from Newfoundland, in which male antennæ are, however, ciliate only.

[636. **M. plicata** Smith?—There is a specimen in the Rutgers College collection taken at High River by Mr. Baird, and dated Sept. 21st, 1907, which seemed distinct from anything known to me in Alberta. It stood near *plicata*, but was spaced apart. It is larger than any *negussa* I have seen from here, and looked to me like a pale specimen of *plicata*. The correct dates, however, for both *negussa* and *plicata* appear to be May.]

637. **M. chunka** Sm.—(Trans. Am. Ent. Soc., XXXVI, 265, Nov., 1910.) Described from three males from Aweme, Man. I have a female in my collection taken at High River by Mr. Baird on May 4th, 1910. Its nearest ally known to me is *crotchii* Grt.

638. **M. lubens** Grt.—High River (Baird), three specimens. Two on April 31st, 1910, on tree trunks, and the other on June 15th, 1914. I have already pointed out that this is distinct from *cristifera*.

639. **M. artesta** Sm.—Two specimens at Dorothy, Red Deer River, July 1st, 1905, flying at dusk, and at High River by Mr.

Baird. Holland's figure under *congermana* appears to be this species.

640. **M. pulverulenta** Smith.—High River, June 16th, 1914 (Baird), one male. Banff (Sanson). Described from Mrs. Fernald's collection as a grey variety of *assimilis*, the reference having been decided by identity in the rather peculiar structure of male genitalia in the two forms. These I have not so far examined, but I feel quite convinced that the two forms are distinct species. In *assimilis* the t. a. line is nearly straight in the sub-median interspace. In *pulverulenta* it is rather deeply crenate. The claviform in *pulverulenta* is both narrower and shorter, and, as a rule, the *orbicular* and *reniform* are smaller. The white patch near the anal angle is usually larger, and there is more white in the s. t. line opposite the cell. A red-brown tinge to the entire ground colour of primaries is not unusual.

No locality is given with the description. In Hampson's Catalogue *pulverulenta* is treated as "ab.1" of *assimilis*, under which specific name only two specimens are listed, a male from Vancouver Island, and a female from Buffalo, N. Y. (Massachusetts in error). Both these specimens are *pulverulenta*, and that from Vancouver Island is figured under *assimilis*. In Vancouver I. specimens the grey overlay is usually very slight. The most intensely black specimens which I have seen are a pair from Tacoma, Washington. The *assimilis* of the Kootenai List is this species.

641. **Barathra curialis** Sm.—Edmonton. A male, rather rubbed, June 17th, 1910. (F. S. Carr.)

[642. **Xylomiges cognata** Sm.—Barnes and McDunnough, in Contr. II, No. 1, pl. vii, fig. 4, figure a male of this species from Calgary. Its occurrence in Alberta is of course possible, but so far I have no authentic record of any Xylomiges from east of the Rockies in Canada besides *dolosa*, with the exception of *tabulata*, which is recorded from Montreal, and is apparently exclusively eastern.]

[643. **X. pulchella** Smith.—In Journ. N. Y. Ent. Soc., XIX, 140, Sept. 1911, Prof. Smith claims to have this species in his

collection from Laggan. Mr. Bean may perhaps have taken it there, and the specimen have come from him. On the whole, the occurrence of a species of this genus at Laggan is more probable than at Calgary.]

644. **Scotogramma submarina** Grt.—Dorothy, Red Deer River, July 1–4, 1905. About eight specimens at snowberry flowers at dusk, by the author and Mr. Arthur Hudson.

645. **S. conjugata** Smith.—Laggan, July 18th, 1907, a fine female at the Chalet lights, by the author. Banff, June 24th, 1912, and July 3rd, 1914 (Sanson.) Hampson figures a Colorado female from the Washington collection. The ochreous shades shown in the figure are non-existent in the specimen.

646. **Anarta richardsoni** Curt.—Wilcox Pass, one male and two females; Mt. Athabasca, three males, 1907. (Mrs. Nicholl.) The specimens are in the British Museum.

647. **A. secedens** Walk.—Banff, July 25th, 1911, June 20th and 21st, 1912. Five males on electric light poles (Sanson). I have compared the type, from St. Martin's Falls, Hudson's Bay Territory. As I stated in the Entomological Record for 1912, this appears to me better placed in Anarta than in Polia, where Hampson places it. A close ally of this species which occurs in Northern Europe and Asia is *bohemanni* Staud. This differs from *secedens* in having a much narrower black border to the yellow secondaries.

648. **A. impingens** Walk.—Wilcox Pass, and Brobokton Creek, Alberta Rockies, 5 males, 1907. (Mrs. Nicholl). One is in my collection, and the rest in the British Museum. Banff, July 3, 4, 1914, a pair at light (Sanson). Laggan, 6,800 feet, July, in coll. J. B. Smith.

649. **A. cocklei** Dyar.—(Can. Ent. XXXVI, 31, Feb., 1904.) *Homohadena*, Brobokton Creek, 1907, one female (Mrs. Nicholl) in British Museum. Laggan, Aug. 23rd, 6,800 ft., one male in coll. J. B. Smith. The latter specimen stood under *funebris* Hbn., to which Hampson finds *funesta* Payk. a prior name. I noted that the specimen was much like a Labrador specimen there, and darker only than European *funesta* in the same collection. So far, I have

discovered no way of separating *cocklei* and *funesta*, and doubt their distinctness. I have Labrador (Moeschler) specimens in my collection which agree with *funesta* in the British Museum. I have named a Newfoundland specimen *cocklei* for Mr. A. F. Winn. Hampson places both in *Sympistis* Hbn., with others from our list of Anartas having eyes ciliate (i.e., overhung by ciliæ) and not hairy.

650. **A. staudingeri** Auriv.—Brobokton Creek (Mrs. Nicholl), one male, Aug. 13th, 1907, in my collection, and four females in coll. British Museum. Up to the date of Hampson's publication in 1905, this species had not been recorded from North America. In the Staudinger Catalogue *mæschleri* and *staudingeri* are listed as vars. of *leucocycla*. Sir George Hampson makes *mæschleri* a var. of *staudingeri*, and *leucocycla* distinct. *Mæschleri* was described from Labrador, whence I have a specimen so named from Bang Haas, probably of Mœschler's collecting. This is greyer than Greenland *leucocycla*, and has not the yellowish secondaries of that, but otherwise resembles it more closely than it does *staudingeri* from the Alberta Rockies.

651. **Tæniocampa oviduca** Grt.—A male on Pine Creek, June 2nd, 1914.

652. **Pleroma obliquata** Smith.—Banff, April 25th to May 8th, 1910, several specimens on electric light poles (Sanson). Head of Pine Creek, April 22nd, 1911, a male at light (E. R. Brill). The specimens are a darker, bluer grey than a Glenwood Springs, Colo. series in my collection. It was described from Colorado. A Vancouver Island specimen is much like the Alberta captures.

653. **P. conserta** Grt. syn. *apposita* Smith.—Banff (Sanson). I have no record of date. In 41st Rept. Ent. Soc. Ont. for 1910 (p. 11 of the "Record") I recorded *conserta* from Banff, and referred to "a form without the black suffusion, which I believe to be the same species." The latter form was *obliquata*, recorded above. *Conserta* has a black cloud over the greater part of the primaries below the basal streak and median vein, as far as the subterminal line, and extending obliquely to the apex from opposite the cell. In other respects the maculation of *obliquata* and *conserta*

seems practically identical, and an examination of the two forms from Banff led me to believe that they might be forms of one species. I have no Banff *conserta* in my collection, but have two from Vancouver Island. In these the fringe on primaries is cut with white opposite the veins, which is not the case with any of my *obliquata*, and my suggestion was probably wrong.

654. **Calocampa thoracica** Put. Cram.—Common some years in September and October, and again in the spring in April and early May. At light, treacle and sallows. Like most hibernating species, it appears in greater numbers after hibernation than before. I am satisfied that this is a distinct species, and not a variety of *cineritia* as described, and as treated by Sir George Hampson.

Ottolengui, in his "Notes on Calocampa" in Journ. N. Y. Ent. Soc. X, 77, June, 1902, says: "The study of the genitalia disclosed the fact that *thoracica* is not a variety of *cineritia*, as it has been described and listed, but a distinct species. This I am told has been corroborated by breeding, the larval stages of the two being also distinct."

Last spring Mr. Tams procured batches of ova from four or five females of each species. As soon as the eggs turned colour a difference was manifest in each case. The egg of *cineritia* is uniform reddish brown. That of *thoracica* is yellowish white,, with the exception of a spot at the top, and a ring half way between that and the equator, which are reddish-brown. The largest batch of eggs procured of each species was kept, and after hatching the two broods of larvæ were carefully isolated. Both broods were found to feed on several different plants, but seemed to prefer willow. No larval differences whatever could be discovered from first to last. Over thirty imagines were hatched from each brood, and both broods came absolutely pure.

In the imago, the difference is almost entirely one of colour. The ground colour of both may be described as blue-grey, but the grey is far brighter and more silvery in *thoracica*. The yellowish streak from the reniform to the s. t. line is less conspicuous, and the area immediately above it always a brighter grey than in *cineritia*. Perhaps the most easily expressed distinctive character

which I have so far been able to discern lies in the subterminal line. This is brighter and more irregular in *thoracica*, and is thrown more into contrast in fresh specimens by the dark preceding and following shades. But in worn and hibernated specimens contrasts become lost. The black dash before the s. t. line opposite the reniform is slightly heavier and longer in *thoracica*. The reddish costal shades are often of a lovely bright chestnut in fresh specimens. They are far duller in *cineritia*. The thorax is always a trifle grey. But none of these characters are at all obvious, and a student will require to become familiar with the sight of both before being able to distinguish them with certainty. Both occur in Manitoba, but I have not so far received *thoracica* from B. C., where *cineritia*, apparently redescribed by Smith as *mertena*, seems widely distributed. I have *thoracica* also from Glenwood Springs, Colo. I have what I believe to be a very dark, small, subarctic form of this species from Dawson City, Y. T., and have seen an exactly similar form taken by Mr. Sanson at Banff.

Mr. Tams has prepared seven mounts of the genitalia of each species, but we are entirely unable to find any difference between the two as Dr. Ottolengui appears to have done. The harpes are bifurcate, and their form at the tip may be likened to a snake's head with open jaws. The relative length and shape of these jaws varies considerably in the fourteen specimens, but the organs of the two species vary to the same extent.

655. **Rancora solidaginis** Behr.—Banff, May 4th, 1911 (Sanson). A specimen bearing this date was sent to me for naming, and I compared it with the British Museum material, amongst which it agreed with a specimen from Osoyoos, B. C. Holland's figure under *solidaginis* appears to be *albicinerea*, a closely allied but paler form already recorded by me from Alberta. In the Entomological Record for 1912, Mr. Sanson records this species from Banff under date Aug. 20th. The date, if correct, is probably abnormal.

656. **Asteroscopus borealis** Smith.—A male, in perfect condition, taken at rest at Red Deer, about April 24th, 1914, by Mr. F. C. Whitehouse, to whom I am indebted for the specimen.

657. **Orthosia inops** Grt.—A badly worn male, taken near the mouth of Fish Creek on Aug. 27th, 1893, probably at treacle, stood for many years in my collection without a name, until I was at last able to identify it with the help of a Manitoba series, one of which I have compared with the type in the British Museum. I have received a number from Manitoba at different times, mostly from Heath. It appears to be hard to get in good condition. It does not belong properly with *Amathes*, which is the generic term used by Hampson for this and other species standing in our lists under *Orthosia*. It differs from the others in having an abundance of hair-like scales amongst the thoracic vestiture, and in the eyes not being overhung by cilia. I noted this concerning the type, and it is so in my series. It belongs with the *Acronyctinæ* as used by Hampson, and is better placed with *Athetis* than with *Amathes*, though its position there does not satisfy me, as it is of lighter build, and the abdomen has more prominent lateral tufts. It varies considerably in size in the Northwest, my specimens ranging from 24 to 33 mm. In Ent. News, XXIV, 256, June, 1913, I referred *Caradrina insipida* Strecker doubtfully to this species, and must leave the matter to be decided by someone who can compare a specimen with the type of that. *Insipida* appears in Hampson's Catalogue as an unknown species referred doubtfully, and probably wrongly, to *Proxenus* Herr.-Schäff. It was described from Wisconsin. *Inops* came from Kittery Point, Maine.

658. **Nycterophæta luna** Morr.—Three specimens at Dorothy on the Red Deer River, northeast of Gleichen. Two of them at rest on thistle heads after a rain storm, the other feeding on a thistle in sunshine. July 24th to 26th, 1907. I understood Mr. C. G. Garrett to tell me that he had taken this species near Calgary on July 14th, 1906.

659. **Schinia acutilinea** Grt.—A female at the Calgary town lights on Aug. 8th, 1910, by Mr. A. F. Hudson. I know of no other record for Canada.

660. **Dysocnemis borealis** Hampson.—(Cat. Lep. Phal., IV, 24, pl. LV, fig. 6, 1903). Mr. A. F. Hudson took a specimen of

this species on May 7th, 1895. It was one of those specimens retained by Prof. Smith from amongst consignments sent him for naming about that time, and we did not meet with it again for years, it remaining as but a vague memory in our minds until I saw the specimen in Smith's collection on my visit to him, fourteen years later. I then recognized it as this species, of which Mr. Hudson had taken three specimens flying in sunshine at sallow blossoms on April 29th, 1906. He took it again in May, 1912, but it remained for Mr. W. H. T. Tams to take the species in any numbers. That gentleman took from 30 to 40 specimens between May 8th and 24th, 1914, in sunshine, at sallow and bearberry blossoms, and at mud patches in dry weather. Mr. Criddle has taken the species at Treesbank, Manitoba, and Mr. Garrett at Cranbrook, B. C. The type came from St. Martin's Falls, Albany River, Hudson's Bay Territory. It is a worn specimen, and totally lacks the natural beauty of fresh examples. Both t. a. and t. p. lines are present in all the good specimens I have seen, the latter fine, thread-like, blackish, outwardly dentate on the veins, inwardly crenate in the interspaces, and showing up well against the large pale region extending from the orbicular to the terminal border, and from the costa to the inner margin. There is a narrow terminal border in sharp contrast to this pale area. The thorax is dark vinous red, and a faint tinge of this colour pervades the primaries, especially towards the apex. This appears to fade to olivaceous brown in flown specimens.

661. **Melicleptria villosa** Grt.—I have four males and a female taken at Dorothy, on July 25th and 26th, 1907. I erroneously recorded these specimens as *Heliaca diminutiva* in 38th Rept. Ent. Soc. Ont. 1907, p. 122 (1908). The female is larger than any of the males, and has larger pale areas on all wings, and possesses the pale mark in the cell before the orbicular, which is one of the characters distinguishing *persimilis*, but entirely lacks the vinous shades of that species. I took a pair in cop. on the top of a hill near Millarville on July 16th, 1911. In this case the female is slightly the smaller and darker of the two, though the maculation is identical with that of the male. Barnes and McDunnough, in Contr. I, No. 4, p. 39, point out that *villosa* and *persimilis* are distinct. Hampson's figure under *villosa* is of

persimilis type, and Holland's figure under *Heliaca diminutiva* (Pl. XXVII, fig. 56) is also *persimilis*.

662. **Calpe canadensis** Beth.—I enter this record solely on the authority of Dr.Holland, who states in the "Moth Book" that the species ranges as far westward as Alberta. Its occurrence in the province is by no means unlikely, though I never saw an Alberta specimen.

663. **Autographa brassicæ** Riley.—I found a worn female in my house on July 6th, 1905, and took a fine male during the following month. Two fine females were taken at light on Sept. 2nd and 3rd, 1914.

664. **A sansoni** Dod.—(Can. Ent., XLII, 349, Nov., 1910). Described from a single fine male taken at Banff by Mr. Sanson on June 10th, 1910. The type is in the United States National Museum at Washington. Before describing it, I had submitted the specimen to Sir George Hampson, and he has described and figured it in Cat. XIII, 546, pl. CCXXXVIII, fig. 32. Mr. Cockle has recently shown me a worn female taken by him at Kaslo, B. C., on July 1st, 1913.

665. **A. octoscripta** Grt.—Two females on Pine Creek, Aug. 21st, 1903, and Aug. 27th, 1914. Banff, Aug. 1910, one male (Sanson). I have a note to the effect that I have seen a second Banff specimen taken by Mr. Sanson. I referred to this form in my notes under *alias* (Can. Ent. XLV, 191, No. 402). I have no longer any doubt as to the form being *octoscripta*, but still lack the material to decide definitely whether it is really distinct from *alias*. I enter it here as distinct, as I think it may be.

666. **A. selecta** Walk.—High River (Baird). Banff, Aug. 4–19, 1910 (Sanson). On page 12 of the "Record" for 1910 I suggested that *selecta*, with the subterminal line waved, might be distinct from *viridisignata*, the more usual form with it dentate. Sir George Hampson treats *viridisignata* as "ab. 1," giving as a character, besides the dentate line: "the lobe on the outer edge of the stigma rounded." Recent observation has led me to look upon the form as varietal only. The sign varies in colour from

golden to green, and in a female from Hymers, Ont., is distinctly blue.

667. **A. v-alba** Ottol.—Banff, Aug. 19th, 1909. A male on an electric light pole (Sanson). The specimen agrees with Ottolengui's figure of the type in all except the sign, which is more like that in his figure of *surena*, though not nearly as wide. The sign appeared to me to be well within the probable range of variation.

668. **Syngrapha parilis** Hbn.—Mt. Athabasca, Mt. Saskatchewan, and Wilcox Pass, 1907 (Mrs. Nicholl). Two of the specimens from Mt. Saskatchewan are in my collection, and are labelled July 27th, 7,500 ft. Holland's Pl. XXVIII, fig.40 is this species, and not *devergens*.

669. **Abrostola urentis** Gn.—A female at Dorothy, on July 5th, 1905, flying at dusk.

670. **Eustrotia albidula** Gn.—Didsbury, June 11th, 1906 (Garrett).

671. **Conochares acutus** Sm.—(Journ. N. Y. Ent. Soc. XIII, 207, Dec. 1905.) Three specimens, two good males and a worn female, at Dorothy, July 5-8, 1905. They were identified by Smith as *elegantula*, but agree with Barnes and McDunnough's figure of a specimen of *acutus* which has been compared with the type. The species was described from Santa Catalina Mts. and Southern Arizona.

672. **Cirrhobolina deducta** Morr.—A worn female at treacle on a fence-post within a few hundred yards of my house on Pine Creek, on July 8th, 1909. I made repeated visits to the spot again, by both day and night, but never saw another. It is a day-flying species common in parts of the southern states. Mr. Cockle has recorded it from Kaslo, B. C., as well as *mexicana* Behr., of which *deducta* seems to me only a variation. It is possibly only a migrant to Canada.

673. **Syneda perplexa** Hy. Edw.—A fine female at Dorothy, on July 4th, 1905. It is exactly like *perplexa* in my collection from Utah and Arizona, and I identified the species by a Glenwood

Springs, Colo. specimen in the British Museum, named, I think, by Dr. Barnes. I know of no other Canadian record.

674. **Catocala pura** Hulst.—A single fine specimen taken at electric light in the town of Red Deer about Sept. 1st, 1914, by Mr. F. C. Whitehouse. The captor has very generously presented me with the specimen, which agrees with Holland's figure of *pura*. That figure has never been corrected, but I cannot vouch for its accuracy.

675. **Epizeuxis lubricalis** Geyer.—Dorothy, July 23rd, 1907. One female at treacle.

676. **E. æmula** Hbn.—A female, at the same time and place, and also at treacle.

677. **Palthis angulalis** Hbn.—A pair at treacle on Pine Creek, June 26th, 1909. Edmonton, 1914. (D. Mackie.)

678. **Bomolocha chicagonis** Dyar var. *perpallida* Dyar. A female taken at St. Albert, northwest of Edmonton, on July 21st, 1904, by Mr. T. N. Willing, is in my collection, and has been so named by Dr. Dyar himself. *Chicagonis* is brownish grey, and was described in Proc. Ent. Soc. Wash. VI, p. 105, May, 1904, from a single female from Chicago, from Mr. Kwiat. But F. A. Merrick sent me specimens from Milwaukee, Wis., claiming that that was really the type locality. I have a Milwaukee specimen also from Mr. Kwiat. In the same paper the varietal name *perpallida* is applied to a pallid whitish ochreous specimen from Turtle Mts., N. Dak. (A. H. Verril). This is the colour of my specimen.

THYATIRIDÆ.

679. **Euthyatira pudens** Gn.—Two males at light and treacle on Pine Creek, July 13th and 17th, 1914.

NOTODONTIDÆ.

680. **Schizura unicornis** Sm. & Abb.—Several specimens. Pine Creek, end May, 1913, and July 10th, 1914. High River, two specimens, one of them July 29th, 1911 (Baird). The species seems a trifle smaller and less robust here than on Vancouver Island.

681. **Gluphisia severa** Hy. Edw.—Banff, May 26th to June 1st, 1910. Several specimens on electric light poles (Sanson). In the Kootenai List Dr. Dyar treats *severa* as a western race of *lintneri*. *Lintneri* occurs at Calgary, but is rare. I have eight specimens at present under examination, two of them females. Of *severa* I have three males from Kaslo, one from Duncans, V. I., and two and a female from Banff. I have little doubt that they are distinct species. In *lintneri* the coloured shades are ochreous. In *severa* they are pale sienna brown. But the colour seems variable both in shade and degree, and may not always serve to distinguish them. The lines differ in course. A basal transverse line is occasionally present in both. There is also an extra-basal line, about midway between the base and the t. a. In *lintneri* this is sharply outcurved in the submedian interspace.. In *severa* it is slightly waved throughout. The t. a. varies in course in both species, but is directed more obliquely outwards from the costa to the subcostal vein in *severa*. The t. p. line is also more dentate and crenulate in the latter, especially near the inner margin. Structurally, *severa* is rather broader winged, and the scaling and vestiture is rather rougher. In my female *severa*, the antennal pectinations are considerably shorter than in *lintneri*, and lie closer along the shaft, giving at first the impression of a simple antenna.

LIPARIDÆ.

682. **Olene plagiata** Walk.—Banff, Aug. 2nd (Fletcher). The record is taken from Barnes and McDunnough's Contr. II, No. 2, p. 75, on "The Liparid Genus Olene." In that work they point that though *plagiata* Walk. has been quite erroneously used for one species of *Olene* (vide also Can. Ent. XLV, 301, Sept. 1913, No. 447, of this list), through *Acyphas plagiata* Walk. iv, 799, 1855, having been misidentified, yet the name must immediately be reintroduced for another *Olene*, which is *Edema plagiata* Walk. xxxii, 427, 1865, and which stands wrongly in our lists as *Symmerista*. I should judge from their figures that this is very likely the species referred to by me from Banff as *styx* B. & McD., though paler than Vancouver Island specimens (43rd Rept. Ent. Soc. for 1912, 121 (1913). Of this Mr. Sanson took four males, July 21st–25th, 1911. As Messrs. Barnes and McDunnough suggest them-

selves on page 76 of the above-mentioned revision, that *styx* may prove to be only a melanic form of *plagiata*, I have no cause to feel ashamed of my record. It may be as well here to mention that B. & McD. have pronounced *Acyphas plagiata* Walk. to be *Hemerocampa definita* Pack. and not *leucostigma* A. & S., as I at first thought. (Contr. II, No. 5, p. 203, Aug. 1914).

PLATYPTERYGIDÆ.

683. **Eudeilinea herminiata** Gn.—Dorothy, July 5th, 1905. One specimen.

OCCURRENCE OF *EUMERUS* (SYRPHIDÆ) IN CALIFORNIA.

BY W. M. DAVIDSON, U. S. BUREAU OF ENTOMOLOGY, WASHINGTON, D. C.

The large Syrphid genus *Eumerus* Meigen is well distributed over the lands of the Eastern Hemisphere, occurring from Britain to Australia. In the Americas there appear to be no indigenous species, but the onion fly (*Eumerus strigatus* Fallen) has been bred from Iris and Amaryllis bulbs in North America. Felt* records that it was reared in New York State from Iris roots found at Saratoga Springs, N. Y., August, 1911. He also states that it has been recorded from Buffalo, N. Y., Connecticut and Brownsville, Texas. During the summer of 1914 I was surprised to find an *Eumerus* on the wing in central California. Ten specimens, of which 8 were males, were secured, the dates and numbers taken being as follows: 1 male at Walnut Creek, Cal., May 25; 1 male at Berkeley, Cal., June 12; 6 males and 2 females at Oakland, Cal., July 26. At Berkeley a few others were observed and at Oakland many more. At both places the flies occurred in gardens flying close to the ground and making short darting flights among the vegetation, thereby reminding one of some of the smaller bees. Professor Bezzi of Turin, Italy, to whom I sent a male, pronounced the specimen very similar to the European *E. tuberculatus* Rondani, which he states is perhaps only a variety of

*Felt, New York State Museum, Report of the State Entomologist, 1911; p. 119.

strigatus Fallen. Mr. F. Knab, of the U. S. National Museum, has pronounced the specimens I submitted to him *strigatus*. It would appear that this European insect has a wide distribution over the United States since it has been taken in the East, South and West. Its habits on the wing are rather similar to those of *Paragus tibialis* Fallen, a common species that superficially resembles the *Eumerus*.

FIELD NOTES AND QUESTIONS.

The Occurrence of Mantis religiosa L. in Canada.

Four specimens of the European Praying Mantis (*Mantis religiosa* L.), taken in Ontario, have been seen by the writer since September, 1914. Three of these were captured in Prince Edward County during the past two seasons, while the fourth was taken some years ago near Simcoe, Norfolk Co. The latter specimen was sent to me for determination by the Rev. Prof. C. J. S. Bethune.

Of the three specimens from Prince Edward County one was taken last year near Picton, and is now in the collection of the Picton Collegiate Institute; a second was taken at Green Point, Sophiasburg Township, about Aug. 15, by Mr. Hugh W. Clark, Assistant Representative of the Dept. of Agriculture, Picton; while the third comes from Carrying Place, and is in the International Collection of Canadian Insects, Ottawa. It was taken by Mr. J. H. Herrington on Oct. 10, 1914.—E. M. W.

Referring to Mr. Bethune's remarks in the January number on "Caterpillars as Weather Prophets," according to Brez in "Flores des Insectophiles, Notes suppl. p. 134," "when a spider spins a long thread, there is a certainty of fine weather for at least ten or twelve days afterward." Of this Kirby had the following to say: "Without going the length of deeming this important enough to regulate the march of armies or the sailing of fleets or of proposing that the first appearance of these barometrical spiders in the spring should be announced by the sound of trumpet, I have reason to believe from my own observations that his statement is in the main accurate and that a very good

idea of the weather may be formed from attending to these creatures."

The above, however, is a conservative forecast compared with the one mentioned by Mr. Bethune.

H. B. Weiss, New Brunswick, N. J.

Insect Importations into New Jersey during the Fall of 1914.

Four thousand six hundred and eight parcels of nursery stock were shipped into New Jersey during the past fall, emanating from such countries as Holland, Belgium, United States of Columbia, England, Germany, Japan, Ireland, Denmark, Scotland, Brazil, Trinidad, France, Cuba, Italy, Canal Zone, Central America and Venezuela. Four-fifths of the above quantity came from Holland and Belgium, these two countries being by far the largest exporters into New Jersey. Every year it is customary to find on this stock what might be called standard infestations and the following list which gives the species found last season may be taken as a fair example of what one can expect more or less regularly.

Diaspis boisduvalii on orchids from Belgium and England; *Pseudococcus* sp. on palms and metrosideros from Belgium; *Coccus hesperidum* on bay trees and camellias from Belgium and Germany; *Chrysomphalus dictyospermi* on palms from Belgium, England and Scotland; *Aspidiotus hederæ* on palms, camellias, lapagerias from Belgium, Germany, England; *Hemichionaspis aspidistræ* on aspidistra from Belgium; *Chrysomphalus aonidum* on palms from Belgium; *Lepidosaphes ulmi* on apple, boxwood from England and Holland; *Targionia biformis* on orchids from Central America; *Isosoma orchidearum* in orchids from Brazil and Central America; *Notolophus antiqua* eggs on roses from Holland; *Aleyrodes* sp. on azaleas from Belgium, Holland, Germany; *Gracilaria azaleæ* larvæ on azaleas from Belgium; Tingitid eggs on rhododendrons from Belgium, Holland; and *Ceuthophilus* sp. in packing around stock from England.

As is seen, scale insects continue to outnumber all other species. This is undoubtedly due to the ease with which they can be transported and overlooked if present only in small numbers.

Harry B. Weiss, New Brunswick, N.J.

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POPULAR AND ECONOMIC ENTOMOLOGY.

Some of the Benefits from Spraying with Arsenates in the Apple Orchards of Nova Scotia.*

BY GEO. E. SANDERS, FIELD OFFICER,
Entomological Branch, Dominion Department of Agriculture.

During the seasons of 1912 and 1913 an experiment was conducted by the local laboratory of the Entomological Branch to determine the extent of benefit from each of the four sprays then applied to the orchards of the Annapolis Valley in controlling the three most important groups of biting insects, namely, the Bud-moths, the Fruit Worms and the Codling Moth.

The orchard under experiment was six to seven years old, standard trees forty feet apart, with Wagner fillers eight feet two inches apart, and when taken was moderately infested with Bud-moths, heavily infested with Fruit Worms and moderately infested with Codling Moth. The results throughout were taken on Wagners. Ten acres of orchard were used, divided into plots of 10-12 acres each.

The composition of the spray used was commercial lime and sulphur, one to thirty-five, and Swift's acid paste lead arsenate, five pounds to one hundred gallons; it was applied with a hand pump. The first application was made when the buds were bursting, as soon as the first Bud-moth started eating its way into the bud, to be referred to as spray 1. The second was applied from two to three days before the blossoms opened, to be referred to as spray 2. The third was applied immediately after the blossoms fell, to be referred to as spray 3, and the fourth was applied two weeks later, to be referred to as spray 4.

The infestation of Bud-moths in the buds in the unsprayed checks at the end of the experiment was 59.56 per 100 buds, while

*Contributions from the Entomological Branch, Department of Agriculture, Ottawa.

in the plots receiving spray 2 and 3 together they averaged 22.1 per 100 buds, or the number of Bud-moths was reduced by 60.75 per cent.

The infestation of Fruit Worms at the end of the first season in the checks (unsprayed) was 12.44 injured apples per 100 picked, while in the plots receiving spray 2 and 3 together there were 4.33 injured apples per 100 picked, or the injury by Fruit Worms was reduced by 65.19 per cent. The second season, with a much lighter infestation throughout the orchard, the benefit was 63.56 per cent. reduction in Fruit Worm injury.

The Codling Moth infested 4.54 per cent. of the apples in the checks in 1913. It was found that spray 2 gave 71.3 per cent. reduction in injury. Spray 3 gave 89.2 per cent. reduction, and spray 4 gave 65.6 per cent reduction. From the fact that the Codling Moth is, as a rule, an insect of minor importance in Nova Scotia, and that it is largely controlled by sprays other than the regular Codling Moth spray, the Nova Scotia apple growers are free to advance or retard by two or three days the first spray after the blossoms, as may be advantageous to them in controlling any other pest, with practically no reduction in benefit to Codling Moth.

The injury done by the three insects under observation was divided into two classes; the first, reduction in the set of fruit, and the second, injury to the picked fruit.

Effect of Bud-moth in Reducing Set

In the Experimental orchard 59.56 per cent. of the blossom buds in the checks contained Bud-moth. Counts of 1000 blossom clusters infested with Bud-moth showed 305 apples set, while 1000 blossom clusters free from Bud-moth on the same trees set 1205 apples. In other words, the reduction in set in the blossoms infested is 75 per cent., or in the checks where the infestation was 59.56 per cent. the reduction in set was approximately 45 per cent. By the use of spray 2 and 3 we reduced the number of Bud-moths by 60.75 per cent., so instead of growing 55 apples where 100 would have set if no Bud-moth had been present, we increased the set to 82, or an increase in set of 49.09 per cent.

Effect of Fruit Worm in Reducing Set.

In the check plots we found 12.44 per cent. of the picked fruit showing Fruit Worm injury. Observations during June showed that 72.48 per cent. of the young fruits injured by Fruit Worms drop to the ground before maturity. So the number of apples which fell in the checks was 32.75 per cent. of the total set on 67.28 apples were grown where 100 would have grown if no Fruit Worms had been present. Spray 2 and 3 reduced this injury by 65.19 per cent. and so increased the set from 67.28 apples to 88.61 apples or an increase in set of 31.7 per cent.

TABLE SHOWING INCREASE IN SET DUE TO BUD-MOTH AND FRUIT WORM CONTROL.

Due to	Per cent. drop due to insect injury.	Per cent. set in unsprayed plots	Per cent. benefit by spraying in controlling insects.	Per cent. set when sprayed.	Per cent. increase in set due to insect control.
Fruit Worm...	32.72	67.28	65.19	88.61	31.7
Bud-moth.....	45.	55.	60.75	82.	49.09
			Total increase in set.....		80.79%

Or where in the treated plots we grew 100 apples in the untreated plots we grew 55 apples.

Bud-moth Injury to the Picked Fruit

In estimating Bud-moth injury to the picked fruit, the counts in the various plots varied greatly, depending on the crop, size of the leaves, etc., so that no accurate idea of control beyond the general benefit in reducing Bud-moth could be gathered. The whole twelve plots averaged 44.7 per cent. Bud-moth infestation in the buds, while 9.5 per cent of the total crop of apples had leaves tied up to them, the surface showing injury by the young larvæ. A total injury of about one apple to every five buds injured in the spring. All apples injured by Bud-moths under the present interpretation of the Fruit Marks Act are packed as No. 3's or "culls," the injury being properly classed as "causing material waste."

Fruit Worm Injury to the Picked Fruit

In the check plots the total Fruit Worm injury was 12.44 per cent. of the picked fruit. Of these 39.5 per cent., or 4.97 per cent. of the total, were so damaged as to be fit only for No. 3's or culls.

In many cases the injury is much greater than this, a larger proportion of those injured being classed as No. 3's and culls.

Codling Moth Injury to the Picked Fruit.

In the check plots the Codling Moth injury was 4.54 per cent., while in the plots receiving spray 3 the injury averaged 5 per cent. Both calyx and side injury were present, and the injury predominating.

TABLE SHOWING INJURY TO THE PICKED FRUIT.

Due to	Per cent. total injury to picked fruit.	Per cent. injury serious enough to throw apples into No. 3's and culls.	Per cent. serious injury in sprayed plots.	Per cent. reduction in injury by spraying before and after the blossoms.	Per cent. increase in marketable apples due to spraying
Bud-moth.....	9.5	9.5	3.8	60.75	5.7
Fruit Worm...	12.44	4.97	1.74	65.19	3.23
Codling Moth.	4.54	4.54	.5	89.2	4.04
			Total increase in marketable apples.....		12.97%

Economic Results.

Apples are seldom worth less than $1.00 per barrel on the trees in Nova Scotia. For every 100 barrels grown by proper spraying in orchards similarly situated to the one in which we experimented, 45 barrels of the picked fruit in every 100 and 12.97 per cent. more Nos. 1 and 2; among those grown may be attributed directly to the control of Fruit Worms, Bud-moths and Codling Moth by spraying. The results obtained were practically from two sprayings, one from one to three days before the blossoms, and one directly after the blossoms. Spray 4 gives some results when applied alone in the control of Fruit Worms, Bud-moths and Codling Moth; but when spray 2 and 3 are applied, the additional benefit of the later spray becomes so small as to be scarcely noticeable.

Cost of Spraying

The cost in Nova Scotia varies, but, on the average, five cents per barrel per application more than covers the cost; reckoning the dilute mixture of lime and sulphur and lead arsenate at one cent per gallon and the cost of the application at one and one-half cents per gallon and two gallons per barrel per application. For two applications of spray mixture costing ten dollars per 100 barrels we had in return 45 barrels more of apples and 12.97 barrels more Nos. 1 and 2 to the hundred due to insect control alone. We did

not reckon any benefit from black spot control, which is even a more important problem, leaving that to the plant pathologists. We conducted the experiment to show that when the weather is fine and black spot not present that spray is not wasted on trees, but that a man pays for his entire four or five applications of spray which the plant pathologists recommend to keep black spot off the various varieties in Nova Scotia from two to three times over by controlling three groups of insects: the Fruit worms, the Bud-moths and the Codling Moth, which are present in every orchard and in every year in the Annapolis Valley, often in greater quantities than in our experimental orchard.

JUNE COLLECTING IN MAINE.—(COLEOPTERA).

BY C. A. FROST, FRAMINGHAM, MASS.

June 17th, 1912, found me in the pleasant little village of South Paris, Maine, which is situated on the Little Androscoggin River in the County of Oxford, formerly famous for its bears. The general elevation of the village is about 350 feet above sea level, and the highest point near there is Streaked Mountain about 1700 feet.

This was the second season I had been able to collect in this place, and as I had confined my investigations to the higher land and the hills in 1910, this year I collected along the river and devoted considerable time to the numerous lumber yards in the village. The most remarkable collecting I have ever experienced was enjoyed in the yard of the Mason Manufacturing Company, which contained huge piles of white pine boards and rapidly diminishing tiers of short logs, mostly white and red (Norway) pine. There were also long piles of slabs, the composition of which showed that spruce, fir, hemlock, and several species of hard woods were used in the establishment.

Between the river and the yard on the east is a thick stand of young white pines, which extends also a short distance on the north side and forms an enclosed angle into which the afternoon sun beats with tropical fury. In this corner the logs, the tree trunks, along the edge of the woods, a pile of empty packing cases, and the sides of several small buildings, provided resting places for hundreds of wood-boring Coleoptera. *Chalcophora virginiensis* and

Monohammus scutellatus buzzed from one resting place to another, and the sweating workmen addressed them in unique, if somewhat lurid, phrases when the huge insects struck them in the face or scratched an erratic course across the back of their neck. In this yard I bottled 160 of the former and 265 of the latter species, most of them being taken on two of the warmest afternoons of the week. *Chalcophora fortis* was taken once on a board pile and *liberta* several times in company with *virginiensis*.

All the specimens of *Dicerca chrysea* seemed to have congregated on the trunk of a sickly white pine at the edge of the woods, where I secured eleven of them. Many of them were so high up that I was forced to stand on a pile of logs and dislodge them with a long pine branch. Those that missed the net in their fall were found clinging to projecting sticks or to the base of the tree, which they must have reached by spreading their wings just before striking the ground. I have noticed this neat bit of parachute work by *Dicerca divaricata* after vainly searching for them on the ground. This species and *punctulata* were taken on the trunk of a maple tree at the south end of the yard. The single specimen of the latter species is my only record for Maine.

Chrysobothris scabripennis was common on the pine logs and *dentipes* became a nuisance as its quick flight distracted the attention from more desirable species. *C. harrisi* was seen four times and, remarkable enough to record, not a specimen escaped.

One *Buprestis impedita* was taken from a pine trunk so close to the ground that it nearly escaped observation. The remains of *B. consularis* were discovered under a board and by careful patching a presentable specimen was secured; then by running melted paraffine into the body cavity it was made strong enough to pin. Many rare specimens might be saved if care is taken in transporting damaged insects from the field and a little ingenuity exercised in repairing them. It is also a good plan to pick up any dead, even though imperfect, specimens and reserve for future examination unless they are well-known forms. I have not forgotten the lesson I once received, for the result brought me an almost perfect specimen of one of my rarest New England Cerambycidæ. I was tramping through a thick forest growth of hardwood, interspersed with huge hemlocks, that clothed the ruggedness of

a Maine hillside in the town of Wales, when I caught a gleam of emerald in a small patch of freshly washed out earth on which a wandering sumbeam for a moment rested. I picked up the specimen and carelessly threw it in to the alcohol bottle, thinking it a new record for *Gaurotes cyanipennis*, for I had never seen it in Maine. Some weeks later, when I came to examine it, I found it was *Anthophilax malachiticus*.

The most conspicuous—that is, after they were once seen—of the *Elateridæ* were *Alaus oculatus* and *myops*, which were taken on the board piles with *Agriotes stabilis* (also taken on raspberry flowers) and *Elater semicinctus*. *Corymbites cruciatus* was taken only once flying in the yard.

When the shadows began to lengthen, the air was filled with minute flying forms—*Scolytidæ*, *Staphylinidæ*, *Lathridiidæ* and many others whose family names have not yet been noted.

On the second day after my arrival, a small sand-bar at the edge of the river attracted my attention, and before I was aware of it, an hour had passed. Here I secured a single *Elaphrus riparius*, my first record for New England, although I have seen several from the Lake of the Clouds, Mt. Washington, N. H. By scooping up water and throwing it over the mud and sand, numbers of *Bembidium*, *Staphylinidæ*, and a few *Omophron americanum*, and *Heterocerus tristis*, were taken.

On another day, when the sun had become obscured and a cold wind had driven all the lumber-loving species to cover, I spent two or three hours throwing water with an abandoned basin upon the stony beach that marks the fording place of an old Indian trail. Here several species of *Bembidium*, *Tachys scitulus*, *Hypnoideus exiguus* a larger species of *Hypnoideus*, *Apristus subsulcatus*, *Omophron tessellatum*, and many species of *Staphylinidæ* were driven out of their hiding places and captured as they scurried about. When the basin failed me and more water came through the bottom than out the top, I turned my attention again to the slab piles and stray bits of lumber. Here I found *Dinoderus substriatus* (?) boring into the strips of bark that clung to small bits of pine slabs. A fine specimen of *Ditylus cæruleus* encouraged me to handle over a cord or so of pitchy pine and silvery hemlock, without further success, except a few well-known *Histeridæ* and *Cucujidæ*.

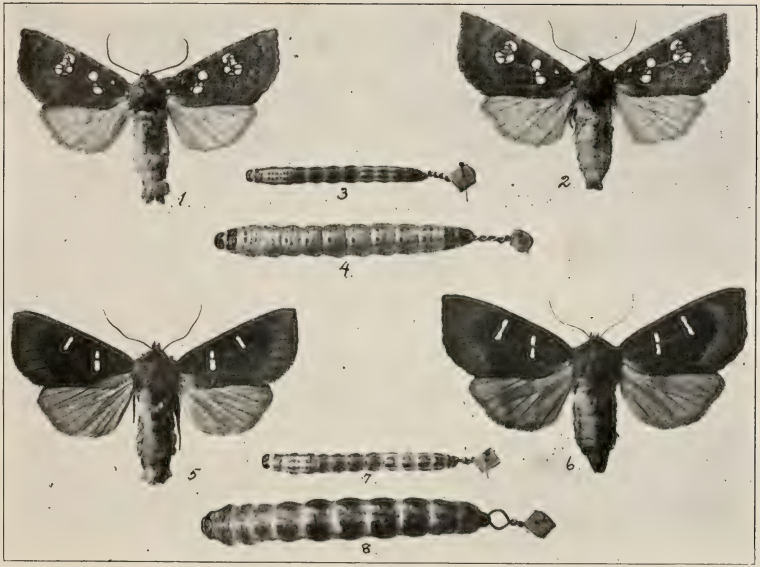
It was here that I secured my second New England record (first one at Wales, Me.) of *Geotrupes semiopacus*, which was boring in the earth beneath excrement. A sluggish *Chalcophora fortis* that was waiting on the end of a log for the sun to appear again, fell over backwards to escape my menacing fingers and landed in the waiting net.

Near here, on a sunny day, I swept two *Agrilus crinicornis* from the leaves of the red raspberry. This genus does not seem to be abundant in Main , where I have collected. I have once found *A. bilineatus* in numbers on red oak leaves and logs, and at another time captured a good series of *pensus* on the leaves of Ostrya. This species was also taken in small number , by beating *Alnus incana* after sunset. A single specimen of the rare *lateralis* was taken at the same time at Wales, Me. A very few specimens of *obsoletoguttatus* have been taken on oak and scattering individuals of *politus* are occasionally seen.

Among the other species taken in this locality were the folowing: *Schizogenius amphibius*, *Amara erraticus*, *Rhizophagus approximatus* (?) *Lathridius liratus*, *Tyrus humeralis*, *Connophron fossiger*, *Xantholinus cephalus*, *Conosoma littoreum* and *knoxii*, *Gronevus* (*Corylophus*) *truncatus*, *Ernobius luteipennis*, *Annobium notatum*, *Ptilinus ruficornis*, *Cœnocara scymnoides*, and *Anthicus ephippium*.

A week is a most deplorably short space of time for an entomologist to explore the possibilities of a new region, and yet, with all the fields and forests before me, I return again and again to the sun-baked piles of logs and slabs, fascinated with the thought that just ahead there is another rarity. The noon hour passes into oblivion, and the faintly stirring memory of an early breakfast vanishes with the capture of a handsome Buprestis. The rays of the afternoon sun come slanting down between the pines and I say to myself, "Just once more around the piles," but the six o'clock mill whistles find me amid the flying bark-beetles and the falling dusk sends me reluctant toward the supper table.

To the entomologist there comes anticipation—and the mind conjures up a beautiful country swarming with unknown forms; realization—and the nature student is delighted with the never-failing unexpected; retrospection—and time has softened the harshness, effaced the petty annoyances, and magnified all that



PAPAIPEMA FURCATA (1-4) AND
PAPAIPEMA SPECIOSISSIMA (5-8)

(See Page 145)

was joyous and beautiful. And as I sit with open box before me and listen to the sleet driven from out the winter darkness against the window panes, I dream of June vacation days—the scent of spruce and fir arises and I gaze across the logs through shimmering heat waves to the cool shadows of the clustering pines.

NEW LIFE HISTORIES IN PAPAIPEMA SM. (LEPIDOPTERA.)

BY HENRY BIRD, RYE, N. Y.

(Continued from p. 115).

Papaipema speciosissima G & R.

A thirteen-year search for the larva of this species, one of the few eastern ones remaining unknown, culminated successfully in 1913. By reason of its fine coloration and large size the species was well known as a moth, even though but few examples ever found a way into collection. At the time of the description in 1868 (Trans. Am. Ent. Soc., Vol. I, 342), Grote and Robinson relate receiving their type from Seekonk, a suburb of Providence, R. I., and an accompanying figure made its individuality clear. Thirty years later Prof. J. B. Smith found "perhaps a dozen female examples" in the aggregate of the principal American collections which he perused when writing monographically of the genus. While known to be generally scattered over the north-eastern United States, most of the examples coming to light of late years bore the label of northern New Jersey. As the establishment of the preferred food-plant through a painstaking search has brought out a bearing of primitive conditions on the result, it may be helpful to relate details.

It was conceded the larva would have a boring habit, its large size would indicate the occupation of some stocky stem or root, so this problem of isolating the food-plant was the first question, and one beset by certain ecological features. So long ago as 1900 the writer visited the type locality in hopes of meeting some plant peculiar to that section which might furnish a clue to the desideratum. Obviously, one way of getting an idea of a likely plant for investigation would be to visit a number of places where the

moth had occurred, compare the floral conditions, and note the suitable plant forms common to such stations. Working on these lines many stations from Montreal, Can., to Wilmington, Del., were visited, but the results led nowhere. What did appear was that the great semi-tidal marsh westward of Jersey City and Hoboken, N. J., yearly gave up a few of the moths, and made it apparent an established colony must be flourishing in these fastnesses. The flora of this region is of the usual luxuriance of an ancient marsh, though modified by a considerable salinity in its lower reaches. Very conspicuous are a number of giant grasses, *Phragmites phragmites*, *Spartina cynosuroides*, *Zizania aquatica*, and others, which are capable and fit to serve as food-plants. For many years we laboured under the impression that some of these grasses must be the answer to the riddle. A number of large herbaceous species also occur and the field for investigation was a large one. From a contemplative viewpoint this habitat offers much to be desired. Many of the floral conditions here have seen little change in the last piling up of centuries, certain sections remaining doubtless in their pre-Columbian verdancy, and we should, theoretically at least, find our larva easily. But the proximity to so great a population has produced much artificiality and the region is interspersed by numerous railroads that are responsible for frequent burnings. The principal hinderance to a thorough search, however, is the fact that the territory is wet to submergence except during very droughty times.

Our meeting with the larva of *P. inquæsita* in a Cryptogam, in 1898, made us early mindful of the ferns, though the food-plants of the genus centre principally among the Composites. Light dawned in 1912 when *P. stenocelis* proves a fern feeder, for *inquæsita*, *stenocelis* and *speciosissima* are a trio aloof from the allies, and it becomes clear we must now also look for the latter in a fern. But what fern was peculiar to the Jersey Meadows? Early in 1913 we found a young borer at work in *Aspidium*, at Rye, but the instance did not reflect a normal operation for our desideratum. Latterly, Mr. Otto Buchholz, of Elizabeth, N. J., had rendered assistance in the Jersey Meadow hunt, being close by the field, and keen, through a wide experience and with a skill rarely equalled, for detective work of this nature. Upon being advised

the search had narrowed down to the ferns, with usual acumen, he soon located the great colony of the Meadows. It developed the common Osmundas are the ones chosen, both *O. regalis* and *O. cinnamomea* being infested. Whether *O. claytoniana* is also bored did not develope, since that species did not occur here, being a denizen of dryer places. While it is a surprise this common fern proves the food-plant so long sought, *Osmunda regalis* being the favourite, and that negative results had followed its examination in hundreds of cases previously, the prominent feature is the localized colony encountered, with the evidence of its probable antiquity. From twenty years' observation on the growth of *Osmunda* under our windows, we do not hesitate to state that most of these individual plants represent fifty years development at least. The gnarled, ruminating root-stocks are elevated 59 to 60 cm. above the level of the quaking morass, in the effort to get above the water and from the nature of the yearly accumulations, and show the borings of preceding generations.

The presence of the larva in *O. regalis* is not easily noted. There is no wilting or drying of a conspicuous frond as happens with the other fern borers. The newly emerged larva enters a miniature stipe whose uncoiled, tender tip has sprung up but three or four centimeters, and in a few days has tunnelled down into the root-stock. This dies, it is true, and is some evidence, but a peculiarity with this fern in this locality seems to be that many more fronds start than eventually mature, what appears to be a fungous blight nipping some in their tender incipiency. Further, a dipterous larva bores these young stipes and causes them to die, so that we find two other similar results produced at the same time in the plant, as is occasioned by the working of *speciosissima*. As the larval period lengthens, the frass thrown out is the only indication, and this is not in the usual well-formed pellets, but a rusty-brown, mud-like deposit. Even this sign is hard to detect for the fruiting fronds send down their brown inflorescence, which, with the chaff-like scales from the stipes sprinkle the root-stock and help to smother the meagre clues. So the apprehension of this larva is not as easy as with most others, and the surprise greater, when, at maturity, one of these old roots is cleft open, disclosing

a pair often of great pink larvæ which have their whereabouts hidden to such a remarkable degree.

The last week of May can be assigned as the date of general emergence from the over-wintering egg, and maturity is reached about Aug. 1. It did not develope that there was the usual amount of parasitism from the smaller hymenoptera that work so assiduously against most of the allies about the fourth instar, and only *Ceromasia myoidæa* seemed to assail the last stages, but this Tachinid was a prevalent check.

The following brief tabulation, except for the first instar, may sufficiently place the larva:

Stage II.—Generically typical, of the group with dark purplish-brown girdle which is not crossed by the white lines; head shows side line; tubercles well developed but not large, blackish, IVa absent on joint ten. Head and cephalic shield concolorous, dorsal and subdorsal lines whitish and broken at girdle.

Stage III.—Colour unchanged, tubercles not prominent, except on joint eleven III and IIIa are fused into a large plate greater than the spiracle and the latter somewhat larger than the anterior ones, and on twelve I and II are of the usual prominence.

Stage IV.—Head has lost dark line at ocelli, is chestnut brown; the cephalic shield is as wide as head, yellow, margined laterally with a black border; lines white and conspicuous, the girdle becomes a shade paler; tubercles the same.

Stage V.—Colour changes to a pinker tone, otherwise similar; the fused III and IIIa on eleven remain the largest of the lateral plates, which on the whole are small.

Penultimate Stage.—Colour is pronounced pink, the translucence at the sutures giving a ringed appearance, the white lines are nearly lost except the dorsal on the thoracic joints; tubercles and spiracles black, the former reduced; III and IIIa have separated on joint eleven.

Maturity.—A robust larva with prominent brown head, cephalic and anal plates, the tubercles except I and II on joint twelve inconspicuous; IVa has never developed on joint ten, and on eleven III and IIIa still more separated, the former the largest lateral plate; IV never gains its usual prominence as occurs with

most other congeners. The colour is a pale pinkish hue, and with the large size is productive of an individuality pronounced with this species. Length, when full grown, 50 mm.; breadth, 7 mm.

The gallery is abandoned for pupation, dates Aug. 1 to 15; emergence of forty specimens range Sept. 1 to 28. The pupa is correspondingly robust, the anal extremity armed with two curved hooks. Length 28, breadth 8 mm.

The larval characters further accentuate the relationship with *inquæsita* and *stenocelis*. Like these species, the slightly enlarged posterior spiracle indicates these larvae have had a super-abundance of moisture to contend against, and is a modification that is yet needed.

Papaipema furcata Sm.

The larva of this species seems to have been first encountered by Mr. Jacob Doll in the vicinity of New York City, but the general habitat is that of the central Mississippi valley. It bores the terminal twigs of Ash, and an instance of economic record against the species is cited by Prof. Washburn in his State Report as entomologist of Minnesota for 1907-08. The mature larva is there described, and a case of damage to nursery stock noted, with suggested remedy for such chance occurrences. My own searchings for this borer from Pittsburg, Pa., eastward have born negative results. Recently the species has been found as a larva in some numbers, by the Chicago collectors, particularly Messrs. A. Kwiat and E. Beer, and I am indebted to the former for these further details of the life history as well as a fine series of larval and perfect specimens.

The larval period extends from May 15 to July 30, considering early emergencies and tardy maturities. The soft, newly grown tip is entered at the base of one of the terminal leaves and the larva works in this portion for a short time. They then leave their burrow here and go back and enter the harder, last season's growth, usually a short distance below the point of the wintering bud. Why they do not continue their first gallery down into the old wood is not clear, for a considerable pith exists in both. However, the move to a new burrow in harder wood seems very general.

Three species of Ash were found infested, *Fraxinus nigra*, *F. americana*, and *F. pennsylvanica*. At maturity the burrow is vacated and pupation occurs in the ground. The larva probably falls to the ground, for such borers at maturity are clumsy and cannot cling well to vertical surfaces. An indication of its early presence exists in the withered leaf at point of entry, with an exudation of frass at the orifice; later when in the harder wood, it is less easily noticed. The larva belongs to that group in the table wherein the lines are broken centrally, but the species considered in its entirety is very distinct.

Stage I.—Markings indistinct, the three anterior and last segments of lighter colour, middle brownish; lines not indicated, tubercles show slightly, blackish; cervical and anal plates prominent; duration of stage assumed to be five days.

Stage II.—Generic characters in evidence, dorsal and subdorsal lines prominent and pure white, they are broken at and unindicated on the first four abdominal segments in general terms, though the break is not exactly at the sutures, these middle segments appear as a girdle in deep purple brown; on joint ten there is indication of tubercle IVa, but the chitinization is not heavy and is concolorous; anal plate of much prominence, shining black. cervical shield much lighter, tubercles black.

Stages III, IV, V.—Appearance similar, the head shining chestnut brown, but lacks the usual black, oblique line at the ocelli; on joint ten IVa is a well emphasized plate.

Stage VI.—The colour fades, the brown tone remaining to the middle girdle, all tubercles and plates retain their prominence, blackly marked, excepting the cervical shield, which is the tone of the head, a yellowish brown, and edged at the side with a black border.

Maturity.—We have now a rather stout larva averaging 40 mm. in length and 6 mm. in breadth; the head is yellowish brown, width 2.8 mm., the colour a whitish translucence throughout, the longitudinal lines lost; the black tubercles and spiracles stand out strongly, of the former special reference should point to joint two, where an elongate plate occurs anterior to Ia and Ib, the fused Xa and Xb apparently; Ia, Ib, IIa show as mere dots, IIb, III

and IV larger, the two latter being greater than a spiracle; on joint ten IVa is as large as IV, and I and II are more quadrately placed than occurs anteriorly; on twelve these are especially large and almost confluent; anal and its preceding plates black, and form a heavy armature to the posterior extremity.

This instance of a black anal plate becomes a specific feature paralleled only with *cerussata*. The larval period seems about sixty days.

The pupa is of the stout, active form normal to the group, with a period of about thirty days. The dates for emergence in a series of fifty-five specimens are Aug. 26 to Sept. 5.

The male genitalic modifications, noted already by Smith, might be suggestive of departures with the female structures to meet some special requirement in placing the egg, but other than a slightly longer ovipositor, there seems no change from the prevalent type. This modification exists in the peculiar two pronged clasper, which is unique absolutely. The eggs which are placed in September hibernate and are likely deposited near the extremity of the branches so the emerging larva may be near the food supply. Parasitism has not been observed so far. The sap beetle, *Ips quadriguttatus*, occurred numerously in the deserted galleries.

Explanation of Plate IV.

Fig. 1—*Papaipema furcata*, male.

Fig. 2—*Papaipema furcata*, female.

Fig. 3—*Papaipema furcata*, larva, stage IV.

Fig. 4—*Papaipema furcata*, larva, mature.

Fig. 5—*Papaipema speciosissima*, male.

Fig. 6—*Papaipema speciosissima*, female.

Fig. 7—*Papaipema speciosissima*, larva, stage IV.

Fig. 8—*Papaipema speciosissima*, larva, mature.

NOTES ON SOME TROPIC REACTIONS OF MACRODACTYLUS SUBSPINOSUS FAB.

BY HARRY B. WEISS, NEW BRUNSWICK, N. J.

During the summer of 1914, while investigating a "rose chafer" complaint in southern New Jersey, a long wait for a train, an abundance of beetles and favourable surroundings tempted me to test the action of this insect in the field under different conditions of light and temperature.

A comparatively cool, shady woods, where the temperature was 75 degrees F., a tree in the open under the shade of which the temperature was 84 degrees F. and a dead leafless tree in the bright sunlight where the temperature was 89 degrees F., constituted all the apparatus at my disposal. Forty-five beetles were collected while feeding and copulating and three batches of fifteen each were liberated one at a time at the base of a tree in each of the surroundings described above. The following table gives the distances (vertical) covered by each beetle.

Shade, Temp. 75 F.		Shade, Temp. 84 F.		Sunlight, Temp. 89 F.	
Beetle	Distance covered	Beetle	Distance covered	Beetle	Distance covered
1	0 ft. 2 in.	1	0 ft. 2 in.	1	1 ft. 0 in.
2	6 " 0 "	2	0 " 4 "	2	0 " 11 "
3	3 " 0 "	3	0 " 6 "	3	0 " 3 "
4	1 " 6 "	4	0 " 1 "	4	0 " 10 "
5	5 " 0 "	5	0 " 2 "	5	1 " 0 "
6	1 " 0 "	6	0 " 5 "	6	0 " 2 "
7	0 " 8 "	7	0 " 2 "	7	0 " 6 "
8	2 " 0 "	8	0 " 3 "	8	0 " 4 "
9	1 " 0 "	9	0 " 4 "	9	0 " 6 "
10	0 " 6 "	10	4 " 0 "	10	0 " 2 "
11	1 " 0 "	11	0 " 3 "	11	0 " 8 "
12	0 " 6 "	12	0 " 4 "	12	0 " 2 "
13	0 " 4 "	13	0 " 3 "	13	0 " 3 "
14	0 " 6 "	14	0 " 1 "	14	0 " 2 "
15	2 " 0 "	15	0 " 6 "	15	0 " 4 "
Totals	22 ft. 38 in.	Totals	4 ft. 46 in.	Totals	2 ft. 63 in.
Averages	20.1 "	Averages	6.2 "	Averages	5.8 "

At a shade temperature of 75 degrees F., the average distance covered was 20.1 inches. At a shade temperature of 84 degrees F., the average distance was 6.2 inches, and in the sunlight, with the temperature five degrees higher, the average distance was 5.8 inches. It thus appears that thermotropism and phototropism either together or alone were responsible for the quicker escape of the insects into the air and the lessened distances covered.

May, 1915

A NEW GENUS OF TACHINIDÆ FROM THE CANADIAN NORTHWEST.*

BY HARRISON E. SMITH,
U. S. Dept. Agriculture, Cereal and Forage Insect Investigations.

Saskatchewania, new genus.

Proboscis long, slender, about two times as long as the dorso-ventral diameter of the head. Labella not well developed. Palpi small, well developed. Head slightly broader than the thorax. Facial plate with broad, highly raised, distinct median carina. Facial ridges bare. Eyes bare. Antennæ inserted near a line drawn through the middle of the eye, descending but slightly below the middle of the face. Parafrontals bare outside of the frontal row. Frontal bristles not descending below base of antennæ. Ocellar bristles weak, proclinate. Orbital bristles absent in each sex. Diameter of head at the vibrissæ as long as at the base of antennæ. Abdomen not bearing the usual macrochætæ. Tip of apical cell ending at the extreme wing tip. Apical cell closed, long petiolate, the petiole as long or slightly longer than the posterior cross-vein. Posterior end of the hind cross-vein nearer to the small cross-vein, than to the margin of the wing. Fourth longitudinal vein, beyond the bend, with a short distinct stump.

Type of the Genus—*Saskatchewania canadensis*, new species.

Saskatchewania canadensis, new species.

Black, densely brassy-gray pollinose. Length 5-6 mm. Frontal vitta bright opaque, brownish black, slightly concave. At narrowest part somewhat wider than the parafrontals at the same point. Front at narrowest part not more than two times as wide as the distance between the posterior ocelli. Ocellar triangle and sides of front grayish pollinose. Head as viewed from the side projects but little in front of the eye. Parafacials grayish pollinose with a strong brassy tinge; about one-fifth as wide as the median depression. Cheeks covered with black bristly hairs, gradually simulating macrochætæ on the anterior margins. About one-fifth to one-fourth as wide as the eye height. Transverse impression of face well defined, concave, piceous. Antennæ black, the first joint scarcely discernible, brownish black. Second and third joints opaque black, the third joint not over two times as

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long as the second. Arista thickened on less than the basal half, the penultimate joint as broad or broader than long. Antennal fovea deeply concave. Median facial carina on its upper surface convex, as broad as the third antennal joint at its greatest width. Vibrissæ cruciate, situated on a level with the front edge of the oval margin, one or two weak bristly hairs above each. Proboscis shining black, once geniculate. Palpi black, slightly thickened at the tip. Occiput, except the epicephalon, covered with numerous short bristly black hairs.

Thorax black, brassy-gray pollinose with four distinct subshining brownish black vittæ, the outer vittæ considerably wider than the two median. Bearing three dorso-central bristles (the anterior two, sometimes very weak), and two distinct sternopleural bristles. Scutellum rather small, broader at the base, gradually narrowing to a rounded point apically. Bearing a pair of long basal and a single pair of long apical, marginal scutellar bristles. Median discal scutellar bristles weak.

Abdomen black, brassy-gray pollinose with a distinct median brownish black vitta. Clothed with numerous long sub-erect bristly hairs, which are somewhat stouter in the male. Hypopygium in the male black, pollinose, bearing black bristly hairs, protruding forward beneath the venter. In the female shining black, distended outward, a narrow deep median hollow groove on the dorsum. The outer margin thickly beset with rather long, flattened, pointed spines, directed upwardly.

Legs black, faintly pollinose. Knees reddish. Middle tibiæ each bearing a single short bristle on the outerside below the middle. Hind tibiæ with a few short bristles on the outer margin. Last joint of front tarsi slightly longer than the tarsal claws. Pulvilli whitish.

Wings hyaline with a yellowish tinge at the base. First and third longitudinal veins not bristly. Posterior cross-vein straight. Bend of fourth longitudinal vein right angular, beyond bend approaching the third longitudinal vein in a straight line. Last section of the fifth longitudinal vein much shorter than the preceding section. Calypteres whitish, with a yellowish tinge along the borders.

Habitat—Saskatchewan, Canada.

Described from two males and four females collected June, August, and September, 1907, at Farwell Creek, South Saskatchewan, Canada. This genus is named in honour of the Saskatchewan region, a very rich collecting ground in the Canadian northwest.

Holotype—One male, Cat. No. 19213, U. S. N. M.

Allotype—One female, Cat. No. 19213, U. S. N. M.

Paratypes—One female in collection of the Boston Society of Natural History; one female in collection of the Massachusetts Agricultural College and a specimen of each sex in author's collection.

GEOMETRID NOTES—NEW SPECIES AND VARIETIES.

BY L. W. SWETT, BOSTON, MASS.

Stamnodes blackmorei, n. sp.

Expanse 21-27 mm. Palpi very short, head dark brown, antennæ mottled brown and white. Thorax and abdomen fuscous, of about the same colour as in *Diastictis inceptaria*. Wings full and rounded, the general colour fawn brown, as in *inceptaria*. The insect at first sight looks like *gibbicostata* Walk., to which it is closely allied. Fore-wings form base to outer two-thirds clear fuscous, except at costa, where they are heavily shaded with brown. About one-fourth out from body the costa is intersected by a white dash and about the middle there is another white dash, followed by a large brownish patch, which extends to the median vein. Beyond this is a broad white band running from costa, at a slight angle, to median vein; then curving inward toward the body and almost disappearing as it nears the inner margin. Bordering this white line at costa is a very dark brown and black patch, sometimes square, sometimes elongated. It is very distinct on all specimens, and is edged outwardly with yellow, followed by two white spots on edge of costa, then a black dot at almost apex of wing. Fringe light brown, with black checks at ends of veins, heavily shaded with dark fuscous from outer to inner margin. Discal dots absent, or, if present, to small too be apparent. Hind wings of same colour as fore wings. Viewed from beneath, the difference between this species and *gibbicostata* is most apparent. Fore-wings beneath darker than above with a rosy hue, the brown markings on the costa above being replaced by reddish beneath. There are the same white spots to the extra-discal band, and the

black spot shows beneath as small and linear. The extra-discal line is quite angled beneath and has a pointed instead of a rounded projection, but the line fades out as it approaches the inner margin. Beyond the extra-discal white line is a large square reddish-brown patch, followed by a whitish ashen patch, which extends to tip of wing, and is marked with two minute points on costa. Beneath this ashen patch the wing is rosy along outer border to inner margin. Hind-wing, from base to white discal dash, clear, with a rosy flush. In *gibbicostata* the same space is heavily striated. In one specimen there is a white extra-discal band curving across the wing; in the others it shows only on inner and outer margins. On the inner margin the white extra-discal line is shaded with a large rosy-brown patch. There is another patch at junction of veins 6 and 7, below outer margin. The outer border is rose-shaded, this colour sometimes running into the checkered fringe.

This geometer can be distinguished from allied species by the conspicuous costal patch above, shaded with red beneath, and the rosy shading of the entire fore-wing. On the hind-wings the two widely-separated rosy-brown patches, white discal dash and extra-discal line separate it from *albiapicata* Grossb. The most distinctive feature is the clear central space extending to the discal dot, which has only a rosy line and lacks striations. I think this species, when once seen, can hardly be confused with any other.

Mr. Blackmore tells me this species is very rare, and even the older collectors, like Mr. Hanham, have seen only one or two individuals. I take pleasure in naming this pretty species after my friend Mr. Blackmore, who has done such valuable collecting in the vicinity of Victoria.

Type—1 ♂, Victoria, B. C., July 3, 1914, from E. H. Blackmore, in my collection.

Paratypes—8 ♂, Victoria, July 2-27, 1913, and 1914, E. H. Blackmore; six in his collection, two in mine (No. 264 and No. 305).

Petrophora defensaria var. **mephistaria** nov.

Expanse 20 mm. Head and body light grey. Fore-wings flesh-coloured and almost immaculate, except for the solid black median band. There are traces of a faint, slightly angled, basal band below the costa, followed by a clear whitish, ashen or flesh-coloured space, extending to the wide, black, median band. Inner

margin of central black band curving slightly outward below costa, then running almost straight to inner margin. Outer margin of band running almost straight to median vein, where there is a deep sinus, then running suddenly outward in a sharp projection, curving back and running straight to inner margin. Beyond this the wing is almost clear, except for a few faint double dots on the veins. Just below apex of wing is a dark dash and a large black spot and on the costa, near the apex, are two black dashes. Fringe ashen with black dots at ends of veins. Hind wings light ashen, with a small, black discal spot, beyond which are five faint wavy brown lines curving across the wing, two being very near together beyond the discal dot. These lines are most apparent on the inner margin. Fore-wings beneath darker than above with the black median band showing through. There is a slight reddish cast near apex of wing and a slight clouding. Black discal spot distinct. Hind-wings crossed by five irregular extra-discal lines, the first three very close together and appearing as dots on the veins. There are traces of two faint lines near the outer margin.

This is a distinct variety and is very striking. The intense, solid, black band crossing the wing will separate it from any others, but the general appearance, except for the band, is much like normal *defensaria*.

Type—♂, Victoria, B. C., Jan. 9. 1909, from Mr. A. J. Croker. Paratype ♂, Ladysmith, B. C., Feb. 3, 1906, from Mr. C. Livingston. Also 1 ♂ from Victoria in Mr. Blackmore's collection. The specimen from Mr. Livingston was received by me through the kindness of Mr. Wolley Dod.

Hydriomena grandis Hulst. var. **saawichata** nov.

Expanse 23-25 mm. Palpi short and slender. Head black, thorax and abdomen dark ashen grey. Fore-wings light rusty brown with a large black basal patch, the exterior line running out from costa to mesial vein. Just below this it forms a projecting almost rectangular point, then running obliquely to inner margin. Beyond this basal patch to the broad central band the wing is rust brown, almost devoid of markings, except two faint parallel rusty streaks in the centre of the space. The intradiscal line runs irregularly across the wing as in *grandis*. The central band is jet black with no inside lines, but the black discal streak is

very noticeable. The extra-discal line is bordered externally with white, like the intra-discal line, but the extra-discal band runs exactly as in typical *grandis*. Beyond the extra-discal line the wing is light rust-red to the outer margin, except for the row of white spots, shaded exteriorly with black, which run from costa to inner margin. At veins 5 and 6 there are two, sometimes three, elongated black streaks and below there is a large silvery-white patch. The fringe is light brown with basal line and intervenular black dots arranged in pairs. Hind-wings light ashen with spots on the veins forming an indistinct extra-discal line. There are traces of two fine reddish hair-lines running parallel across the wings. Fringe light brown with double spots at margin. Fore-wings beneath smoky brown, the black central band showing through faintly, and a dark brownish band near outer margin. Hind-wings darker than above with black discal dot more conspicuous. There is an irregular black extra-discal band with dots on the veins. Beyond this, towards outer margin, are two irregular, parallel, red lines crossing the wings.

This variety is very striking and does not resemble typical *grandis* closely, the latter having the central band fawn brown, as is also the outer border of the fore-wings, and the central band is composed of double extra and intra-discal wavy lines.

I am not sure that this is not a distinct species, but, realizing the great variability of the Hydriomenas, I prefer to treat it as a variety of *grandis*. I have placed this species and the variety temporarily in the genus Hydriomena, which seems to be a resting place for mixed genera, until these can be separated more satisfactorily by a study of their habits and genitalia. Such species of Hydriomena as *autumnalis*, *fuscata* and allied forms, constitute a natural group, distinct in markings and in life histories, but no satisfactory separation of the species has yet been made upon a structural basis.

The present variety was discovered by my friend Mr. E. H. Blackmore, who called my attention to its distinctness from typical *grandis*, and suggested the name *saawichata*. I have never seen it in any other collection, and he assures me it is rare.

Type ♂, Victoria, B. C., May 28, 1914; E. H. Blackmore.

Type ♀, Victoria, B. C., May 5, 1914; E. H. Blackmore.

Paratypes 1 ♂, *4* ♀, Victoria, B. C., May 28 to June 20, 1914; all in Mr. Blackmore's collection.

A FOSSIL FUNGUS-GNAT.

BY T. D. A. COCKERELL, BOULDER, COLORADO.

Some time ago Miss Olive M. Braden collected a number of fossils in the Miocene shales of Florissant, Colorado, and through the kindness of Mr. A. E. Holch, of the Cripple Creek High School, I was enabled to examine the series and identify the species. Miss Braden very kindly gave to the University of Colorado Museum several species new to our collection, the most interesting being a fungus-gnat, described below. It is remarkable to find such fragile insects excellently preserved, and to note that they are entirely of the same type, in many instances, as their modern representatives. In a million years or so, some of the Mycetophilidæ appear to have remained without evolutionary progress, except to the extent of slightly modifying or shifting minor specific characters.

Mycetophila bradenæ, n. sp.

Length about 6 mm.; general appearance and structure exactly as in the living *M. punctata* Meigen, but anterior tibial spurs longer. Antennæ cylindrical about 1.5 mm. long, joints about as broad as long; wings brownish, not spotted, venation quite normal for the genus; abdomen with alternating light and dark bands; hind tibiæ with two rows of long dark spines, as in *M. punctata*, about 320 microns long; anterior tibiæ about 990 microns long, with spur 660. The following wing measurements are in microns: End of subcosta (on radius) to origin of radial sector, 660; length of radio-medial cross-vein, 225; branching of cubitus basad of level of lower end of radio-medial cross-vein, 160; branching of media from lower end of radio-medial cross-vein, 145.

This is the first genuine *Mycetophila* found fossil in America. Scudder's *M. occultata*, from White River, Colorado, is said to have the legs unarmed, and not very long, and the venation cannot be clearly made out. It is evidently not a true *Mycetophila*. In Europe *Mycetophila* is known by a number of species from Baltic Amber, of Oligocene age.

PODISMA FRIGIDA BOH. IN ALASKA.

BY A. N. CAUDELL, BUREAU OF ENTOMOLOGY,
U. S. Dept. of Agriculture, Washington, D. C.

Among a number of miscellaneous insects recently received by the United States National Museum from the International Boundary Survey were two species of Acrididæ collected by J. M. Jessup in the extreme northeastern part of Alaska. The labels on these specimens read as follows: "International Boundary, Alaska, J. M. Jessup. Lat. 69° 20 N., Long. 141º W. 8-VIII-12." Of the two species of Orthoptera received there were fifteen specimens, one male and three female specimens of *Gomphocerus clavatus* Thom. and five male and six female specimens of a short winged grasshopper, which is determined as *Podisma frigida* Boh. While this record of *P. frigida* from Alaska is of interest, being the first reported occurrence of this European species in the New World, it is in no way remarkable, being but an eastward extension of the known distribution.

Podisma frigida was described from Norway, and has been reported from various points in northern Europe and Asia and from the mountains of Switzerland. Material of both sexes from Norway and Switzerland is in the National Museum collection, having been received from Saussure, who was quite surely responsible for the determination. Noticeable variation exists in this material from these two regions, but direct comparison of the Alaskan material with the specimens from Norway shows scarcely any taxonomic divergence. As the Alaskan specimens exhibit no tangible structural differences from material from Norway, the typical region of *frigida*, it has seemed wise to determine them as that species.

Of the known North American species of *Podisma*, the *nubicola* of Scudder is the most nearly allied to *frigida*, Here, however, as usual throughout the Melanopli, the genital structures of the male furnish excellent diagnostic characters. Thus in *frigida* the subgenital plate of the male is apically conical and noticeably elevated above the lateral margins and the cerci are about three times as long as the median width, while in *nubicola* the subgenital plate is more truncate apically and barely elevated above the lateral margins and the cerci are not, or barely, more than twice as long as the median width.

May, 1915

NOTES ON THE CAUSE OF THE BLUE COLORATION OF THE BLUE LYCÆNIDS.

BY H. M. SIMMS, MONTREAL.

The question has recently been raised by certain entomologists whether the blue tint of the blue species of the genus Lycæna and its allied genera is actually due to blue pigment or dye in the scales of the upper surface of the wings, or whether it is due to a kind of "construction" similar perhaps to the apparent construction of a green tint on the under surface of the wings of certain species of the genus Euchloe. The latter, as is well known, on examination by a microscope, is found to be caused not by a field of green scales, but by one of black and yellowish scales intimately mixed in approximately equal quantities. I do not think that it has ever been suggested that the blue colour of the Lycænids is produced by an exactly similar *mixing* of scales of two distinct colours, but it has been suggested that the blue tint is due to the superposition of a layer of white, practically transparent scales over a layer of dark-brown or blackish scales, and that the blue effect is in reality either an illusion as in the case of the Euchloid green tints, or else a phenomenon of interference of light, analogous, perhaps, to the production of the rainbow tints between two reflecting surfaces very close together and separated by a transparent medium, these being known as "Newton's Rings." They are familiar to all in the bright colours visible on the surface of soap bubbles as well as the bright tints seen on the surface of stagnant water, or on the fine film of oil covering the surface of oily water and at times in puddles of automobile oil on roads. Now it can, I think, be clearly shown that this latter suggestion is not the correct explanation of the present case. The colours of "Newton's Rings" depend upon the angle from which they are viewed, as well as upon the distance between the surfaces. If one looks at stagnant water from different angles, it will be seen that the colour at any one point varies according to the angle, and if the blue colour were due to any such cause as those which produce "Newton's Rings," the colour should pass right through the spectrum from red to violet or vice versa, as the angle of sight was shifted. But not only is this not the case, but if the wing of a blue butterfly is placed between two strips of glass and subjected to pressure, thus changing the distance between the two surfaces of any one scale and also between the two layers

of scales, it will be found that there is no corresponding change of colour, thus showing that the colour is not due to interference of the light reflected from the surfaces in question.

On the other hand, an examination by means of the microscope reveals the fact that the light and dark scales are not mixed, as are the yellow and black scales of the Euchloids, and hence the blue colour is not due to the *mixing* of two other tints. The scales are arranged in two layers, the top one consisting of the whitish transparent scales, and the lower one of dark opaque scales of a dark-brown or black. In male specimens there are also a vast number of small sexual scales known as "androconiæ" or "plumules," but these do not contribute towards the coloration, and need not be considered here. There are left for consideration three possible explanations of the blue effect produced by this arrangement of the scales.

1.—By diffraction of light from the finely striated upper surface of the top layer of scales in the same way that colours are produced when white light is reflected from the finely ruled mirrors of a diffraction spectroscope. This theory is untenable, however, since the colour would have to range from red to violet, according to the angle of view, and at any one point would only give rise to such colours in a line at right angles to the striations and not in one parallel to them. The effect of diffraction is, however, seen in those species of Lepidoptera which display "sheen." This not only varies according to the angle, but at any one point becomes totally invisible when looked at from a point in line with the striations. This sheen, however, is an additional source of colour, and is quite independent of the general tint of the insect.

2.—As an optical illusion due to seeing the dark layer of scales through a whitish transparent upper layer. This explanation will be considered together with the 3rd and last, namely, that it is due to internal colouring matter in the upper scales. It has been held that this latter explanation cannot be correct, because when loosely scattered scales from the blue surface are examined by means of a microscope with transmitted light, the blue effect totally disappears and we see only an equal number of dark brown or blackish scales and yellowish transparent ones, which are sometimes nearly colourless. This, however, is not a valid objection, since many colouring matters appear of a totally different colour

by transmitted light. Gold leaf appears yellow by reflected light, and green by transmitted light. A solution of chlorophyll in alcohol appears a beautiful green colour by transmitted light, but blood-red by strong reflected light. Aniline dyes show this property also, and hence it is quite possible that if there is colouring matter in the scales, that it may also show complimentary colours when viewed by reflected and transmitted light. Now, the light scales always appear more or less distinctly yellow by transmitted light, and yellow is complimentary to blue. If now such an assemblage of loose and scattered scales be viewed by a microscope with reflected illumination and against a dark or quite black background, it will be at once seen, provided the illuminating light is white or nearly so, that the light scales are strongly tinted with blue and often are *very* blue. The dark ones on the contrary remain dark and show practically no colour except occasional metallic flashes tinted either blue, green or red. Hence we see here that the light transparent scales have undoubtedly the power to appear blue quite independently of whether they are superimposed on the dark ones. If they are now examined against a white background, such as a piece of white paper, they still appear bluish, but are much paler in colour owing to their transparency. If they are further observed against backgrounds of different colours, red, green, yellow, orange, violet or blue, they always appear distinctly blue, although the background may be seen through them, thus complicating the apparent colour. Against a neutral background or a dark-brown one such as dark-brown paper they appear as blue as when viewed in their natural positions on the wing. Furthermore, when two of these blue scales overlap the density of the blue is very much increased, and in the natural positions they occupy on the wing there is a great deal of such overlapping. Again, it will be noticed that the blue scales taken from the wings of very pale or silvery blue butterflies, such as *Lycæna argiolus*, or *pseudargiolus*, appear very pale blue when isolated and examined by reflected light, and are practically invisible against a background of white paper. With transmitted light they appear very pale yellow. Similar scales taken from butterflies of a more intense blue, such as *Lycæna bellargus*, appear darker blue by reflected light, and much darker yellow by transmitted light, which is easily and obviously explainable on

the hypothesis that the colour is due to pigment or dye, but is not explainable if the colour were due to the superposition of white transparent scales on a background of black or dark-brown ones. Finally, further light may perhaps be thrown on the subject by actually analysing the colours as they are emitted from the wing, by means of the spectroscope. To do this I improvised a small spectroscope attachment to an old and low-power microscope in my possession. When I examined the wings of white butterflies or moths, the whole spectrum was clearly visible. When I examined the red portions of such butterflies as *Vanessa atalanta*, *Parnassius apollo*, the under wing of a Catocala or the red spots on a Zygænid, the red portion of the band remained brilliant, but the yellow and green was greatly weakened and the rest was practically invisible. Orange and reddish-brown butterflies, such as the Argynnids or *Chrysophanus hypophlœas*, gave strong red and orange bands, weaker yellow and the rest of the spectrum was very much weakened, but nevertheless contributed something to the total effect. When I examined the wings of *L. pseudargiolus*, I found the green, blue and violet strong, as I expected, but there was some red and yellow present also, but weak. The intensely blue wing of *L. bellargus*, however, gave brilliant green and blue bands, rather weaker violet and very weak red-yellow and orange. When it is considered that these experiments were made with the light of an incandescent gas burner, the results are not surprising. Such light is known to be deficient in the blue and violet rays, but are strong in the yellow and red rays, although ,of course, the entire spectrum is clearly visible. Again, the presence of red in every case is, I think, partly due to total reflection from the metallic surfaces of the scales at angular points and from the glass itself which covers the wing in those cases where a slide was made for the purpose of examination. Also it is notoriously difficult to produce artificially a green or blue colour free from red, though it is easy to produce red free from blue and green, and this difficulty may also be felt by nature in preparing the natural tints of insects. In any case the strongly-marked blue end of the spectrum and the much-weakened red end show clearly that the scales themselves are inherently blue, in that the total colour emitted by the wing *is* actually blue and is not a mixture of rays from a brown or black surface seen through a white transparent layer, which

from some unknown reason produces a blue sensation in the eye.

To sum up briefly, it appears to me that there is very little evidence in favour of any theory except the old and hitherto unquestioned one, that the blue colour of these butterflies is due to internal colouring matter, probably a dye of some sort, since, as far as I know, pigments, properly so called, do not show complimentary colours when seen by transmitted and reflected lights. The presence of the dark background is probably for the purpose of cutting out all transmitted light which might give a yellow tinge to the blue, and to hide the variegated pattern of the underside, which otherwise, owing to the transparency of the blue scales, would be visible through them and finally to give a greater depth to what would otherwise be an extremely pale tint.

(Read before Montreal Branch Ent. Soc. of Ont., Feb. 20,1915.)

FIELD NOTES AND QUESTIONS.

New Jersey Nursery Insects For 1914.

The following is a list of the commoner species found in New Jersey nurseries. Most of them are confined to ornamental stock, inasmuch as this class of plants occupies 2400 acres out of an acreage of 2600 for all the nurseries, the remaining 200 being planted to fruit stock, bush berries and strawberries.

Aspidiotus perniciosus Comst. Light infestations on left over fruit stock, mountain ash, hawthorn, currants, gooseberries, *Cornus sanguinea*, *Aronia arbutifolia*, Chinese privet, standard privet, *Spirea sorbifolia*, snowberry.

Lepidosaphes ulmi Linn. Increasing in importance and numbers. Does far more damage than the San José Scale. Found principally on lilacs, poplars and willows.

Gossyparia spuria Mod. on elm. *Chionaspis euonymi* Comst. on euonymus. *Aspidiotus forbesi* Johns. on cherry. *Pissodes strobi* Peck. more abundant than usual in white pine.

Scolytus rugulosus Ratz. common in left-over and neglected peach and cherry stock. *Cryptorhynchus lapathi* L. in poplars and willows. *Agrilus viridis* Linn. var. *fagi* Ratz. fairly abundant in *Rosa rugosa*. *Agrilus sinuatus* Oliv. in pear, scarce.

Galerucella luteola Mull. on elms. *Cyllene robiniæ* Forst. in locust. *Melasoma scripta* Linn. present in small numbers on poplars and willows. *Podosesia syringæ* Harr. in lilacs. *Macro-*

noctua onusta Grt. very abundant, doing considerable damage to iris in many parts of the state. *Zeuzera pyrina* Linn. noted in lilacs, shade trees, pear and apple stock in northern New Jersey nurseries. *Hyphantria cunea* Dru. fairly common on all kinds of trees and shrubs. *Certomia catalpa* Bois. on catalpa. *Vanessa antiopa* L. on Lombardy poplars and elms. *Thyridopteryx ephemeræformis* Steph. on spruce, arbor vitæ, lilac, maple and deciduous cypress. *Pteronus ribesi* Scop. on currants and gooseberries. *Vespa crabro* L. and allied species stripping bark from various plants, especially lilacs. *Leptobyrsa explanata* Heid. on rhododendrons. *Trioza tripunctata* Fitch. on blackberries in southern New Jersey nurseries. *Eriophyes pyri* Pgst. on pear. *Eriophyes quadripedes* Shimer. common on silver maple. *Aphis forbesi* Weed on strawberry roots in southern New Jersey nurseries, scarce. *Chermes abietis* Linn. scarce, on spruce in northern New Jersey. *Aphis mali* Fabr. very abundant the past season; did considerable injury to apple stock. *Schizoneura lanigera* Hausm. on apple.

Tetranychus bimaculatus Harv. on evergreens, shade trees.

HARRY B. WEISS, New Brunswick, N.J

BOOK REVIEWS.

MEDICAL ENTOMOLOGY.

"Handbook of Medical Entomology." By W. A. Riley, Ph.D., and O. A. Johannsen, Ph.D., IX, 348 pp., 172 figs. Comstock Publishing Co., Ithaca, N. Y. Price, $2.00.

This volume is the outgrowth, we are told, "of a course of lectures along the lines of insect transmission and dissemination of diseases of man given by the senior author in the Department of Entomology of Cornell University during the past six years." It is intended "to afford a general survey of the field and primarily to put the student of medicine and entomology in touch with the discoveries and theories which underlie some of the most important work in preventive medicine. At the same time the older phases of the subject—the consideration of poisonous and parasitic forms —have not been ignored."

The authors do not expect that the book will meet the needs of the specialist, that is not its purpose, which is to serve as a book of reference to physicians, sanitarians, working entomologists and

teachers. The admitted purpose of the book prevents us from making certain criticisms that we might otherwise feel disposed to offer regarding the treatment of the subject. As a work of reference for the entomologist and sanitarian who is not a specialist on the subject, the book will prove to be very useful, as it contains the kind of information not hitherto collected in so convenient a form by previous treatises on the subject. The contents are made easily accessible by a full index.

In treating the various groups of insects and diseases, the authors summarise the historical facts and experimental work, and describe the diseases, the methods of transmission and eradicative measures, thus presenting in a convenient form the essentials of the subject. A fairly extensive bibliography enables the student, if he has access to the literature, to pursue the subject further, should he wish to do so, although the memoirs of the authors quoted are not always given in the bibliography, which is only intended as an avenue to the more specialized fields.

The authors are inclined, we think, to assume from time to time too great a knowledge of medical terminology on the part of the non-medical student or reader; a difficulty that might be obviated by means of a glossary.

While the book deals with species from all countries and will therefore be of use to a wider constituency than that of North America, in the selection of typical forms the choice has naturally been made from those occurring on this continent. The synoptic tables given at the end of the book, together with the figures, will prove of great assistance to students, as also the notes given from time to time in regard to securing material. The illustrations also greatly add to the value of the book as they are representative in character.

The omission on page 216 of the name of Bruce in connection with the origin of the idea that the Sleeping Sickness trypanosome is carried by *Glossina palpalis* should be corrected, for to him belongs the chief credit of this discovery. On page 215 "Bugosa" should be Busoga. The authors are to be congratulated on having a publisher who not only produces a well-printed book, but enables them to include in the text an abstract of a paper published in the month previous to the publication of their book! It is a book

that is sure to appeal to a large circle of readers; it is reasonable in price, and will, we hope, assist in swelling the increasing body of investigators now devoting their attention to a branch of entomology that was so long neglected. C. G. H.

Monograph of the Bombycine Moths of North America—Including their transformations and origin of the larval markings and armature. Part III, Families Ceratocampidæ, Saturniidæ, Hemileucidæ and Brahmæidæ. By the late Alpheus Spring Packard. Edited by Theodore D. A. Cockerell. Vol. XII, First Memoir, National Academy of Sciences, Washington, D. C., 516 pages, 4to., 113 plates, 34 of which, depicting larvæ, are coloured.

This sumptuous volume contains the remainder of Dr. Packard's work on the Bombycine Moths, two other parts having been published some years ago. At the time of his death in 1905, the author left a large amount of material which he had prepared with a view to the completion of his monograph; though necessarily incomplete, the great value of this material rendered it highly desirable that it should be made available, and thus the present publication was brought about. It is in great measure due to Prof. Cockerell that the undertaking has been so satisfactorily accomplished. The species described are by no means confined to North American forms, but have been drawn from various parts of the globe, as the author evidently had in view the preparation of a complete monograph of the Saturnioid Moths of the world.

The Australian Zoologist.—The Royal Zoological Society of New South Wales has begun the publication of a magazine, of which the first part has been received. It is edited by Mr. Allan R. McCulloch, and printed at Sydney. The number contains 36 pages, large octavo and four plates. The contents include papers on Australian birds and bird sanctuaries, fish, the photograph and description of a live chimpanzee, and the following papers on entomological subjects: The Mallophaga as a possible clue to Bird Phylogeny; A Monograph of the genus Tisiphone (butterflies), and A New Victorian Araneiad.

Mailed May 8th, 1915

The Canadian Entomologist.

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POPULAR AND ECONOMIC ENTOMOLOGY.

SOME MANITOBAN WATER BEETLES.

BY J. B. WALLIS, WINNIPEG, MAN.

Entomologists in Manitoba have as yet given but little attention to the aquatic Coleoptera, so that our list of these interesting insects is but a short one. Mr. Norman Criddle, of Aweme, has done some work among them, and I, too, have given such time as could be spared—unfortunately all too little—so that our captures comprise practically all the local records. Some seven species of *Haliplidæ*, fifty of *Dytiscidæ*, seven of *Gyrinidæ*, seventeen of *Hydrophilidæ*, and but two or three of *Parnidæ* is but a poor list for a Province containing such a variety of water formations as Manitoba.

A few years ago there was a most charming crescent-shaped slough situated in Elmwood, and only a half mile from my home in Winnipeg. When I first knew it, it was perfectly wild, hardly a house on that side of the river within a mile. To get to it from St. John's, Winnipeg, one had to go by boat across the river or else about four miles round by street-car and then walk a mile.

But it was well worth the journey. On the southeast side of the slough, in the hollow of the crescent, was a rise clad to the water's edge with poplar and oak mixed with many of our prettiest flowering shrubs—Saskatoon plum, hawthorn, tree cranberry and others. What a paradise for the nature-lover it was on a sunny morning in late May! As one strolled quietly through the wood many of our most beautiful birds were sure to be seen or heard. Here a flash of gold and the rich note of a Baltimore Oriole, there the black, white and rose of the Rose-breasted Grosbeak; down among the willows by the water the Myrtle Warblers are busy; in the slough itself the cry of a Grebe or Coot or perhaps the booming of a bittern.

And the water itself! How it reflected every one of Nature's moods. Now frowning as a cloud passes over the sun; now smiling back when the sun smiles down through a rift; now rippling in glee as the gentle breeze kisses it. But more than all, how mysterious it is! As one stands and looks down into its depths, one can understand why the Greeks peopled the water with Naiads. It would not be a very great surprise if a dragon *did* suddenly arise from the cool water and sally forth to find its dinner!

Indeed, though the day of the fiery dragon is long since gone, there are many fearsome beasts below the calm surface, each as terrible in its way as the dragon of St. George. Come and look down through this opening in the weeds. Now see! There is a dragon for you! That creature, about an inch long and a quarter wide, grayish-white in colour, with the huge pair of jaws, is a water tiger, and well deserves his name. No insect or tadpole into which he can sink those jaws is safe from him, and his appetite is similar to Oliver Twist's, except that he always wants more. Some day he will be a big, black, shining beetle. Look again! Do you see that creature on the dead vegetation at the bottom? It moves very very slowly now. Does it not remind you of a cat stalking a mouse? Well, it *is* stalking something—some tiny creature that is near to it. When within range, an extraordinary "jaw" is suddenly shot out and—our dragon goes off feeling a little more comfortable! By-and-by that ungraceful creature will be a glittering dragon-fly and will charm us with its fairy-like movements and appearance.

It was in that slough that, with a beginner's luck, I took several rare beetles. With an enthusiasm worthy of success I went over to it early in April. It was so cold that the net would stiffen with frost when out of the water and the sheltered parts of the pond were masked with ice. Looking over my records, it is surprising how many are for 13.IV and 15.IV. They include a species of *Laccophilus* to which Mr. C. H. Roberts, of New York, has given a manuscript name, and two specimens of *Hydroporus oblongus* Steph. Of the former I have since taken but one specimen; of the latter, none.

In the first week of May, in the same slough, two more prizes turned up: *Hydroporus rufinasus* Mann and *Agabus clavatus* Lec.

After many, many hours searching *rufinasus* has failed to reappear, and but two *clavatus* several years apart.

That slough has, alas! now disappeared, and in its stead are long streets of ugly houses.

Another haunt of mine has lost most of its charm from being drained. That is Boundary Creek, not far from Winnipeg Beach. Less than two hours' run from Winnipeg, it was a delightful hunting ground to spend a Saturday at. Early in June it was at its best. In swampy ground near it were clumps of iris, and in shady spots clouds of marsh marigolds. On rising ground to the east were flowering shrubs, oak and poplar, and everywhere some flower or leaf doing its best to be beautiful.

And how insect life abounded! The air was fairly full of dragon-flies—some of them, such as *Leucorrhinia borealis* and *Somatochlora macrotona*, quite rare ones. Butterflies and a few day-flying moths were hovering over the meadow, while on the surface of the water "striders" were darting here and there and "whirligigs" were madly deserving their name.

It was in the clear, slow moving water of this Creek that I took *Polydotes tortulosus* Robts., and down near the old single plank bridge—now gone—one specimen of a new Gyrinid, to which Mr. Roberts assigned a manuscript name. He had one other specimen, and the two matched exactly. It differs from all other species of *Gyrinus* that I have seen by its shape, which is much longer in proportion to its width than usual; in fact, it looks as if it had been "pinched." Since then I have taken hundreds, and casually examined thousands of this genus in the hope of finding more of my friend, but with no success, nor has search for *tortulosus* been better rewarded.

When hunting for water beetles, a very strong net ring must be used and a short bag of stout cotton or similar material. A good-sized square of cotton on which to dump your catch of mud, leaves and weeds is a necessity, as you can then pick out prizes at your leisure and allow anything not required to escape. Some species are very lively and jump around in vigorous effort to escape; others feign death and do not move for minutes. *Parnids* are often found in rapid-running streams, and the following method suggested to me by Mr. Roberts is a good way of hunting them.

Anchor your dumping cloth across stream in shallow water. Stir up the stones, commencing several yards up and working down. Take your cloth to the bank and pick off your catch as the *Parnids* cling to the surface of the material.

Where to hunt is a difficult matter to suggest. In Winnipeg a number of species, especially *Dytiscus*, come freely to light. Rivers, excepting under stones in rapids and among weeds in back waters, are usually unproductive. Slow moving, weedy creeks or muddy weedy ponds are usually good ground, but one occasionally most unexpectedly comes across species in numbers. Several years ago I had hunted for hours in some water near Selkirk with the poorest of success. Just about giving up in despair, I waded across a shallow bay in which not a weed could be seen. Making a stroke almost without thinking, I brought up my net swarming with a species of *Haliplus* new to me, which turned out to be the rather rare *borealis*. Since then *borealis* has turned up in several places near here, but always in ones or twos. In general, try in shallow water rather than deep, and in warm spots rather than in cool shades.

We have several interesting species of *Haliplidæ* in Manitoba. These include three of Mr. Roberts' new species: *H. subguttatus*, *H. strigatus* and *H. tortulosus*. Two others are *H. borealis* and *H. cribrarius*.

Among our more interesting *Dytiscidæ* is a species of *Laccophilus*, to which Mr. Roberts has given a manuscript name. It is very near *mexicanus* Aubé. Its haunt appears to be muddy sloughs in early spring. Then there is *Deronectes depressus* Fab. =*brevis*, according to Mr. Roberts, which is not uncommon in Sturgeon Creek near here. *Hydroporus vittatus* Lec. is a charming little striped species which, so far as I know, is represented from Manitoba by but one specimen taken in an eddy in Sturgeon Creek. The stream was much swollen by rains, so probably poor little *vittatus* had been swept down from some comfortable marsh. At at any rate, it appeared to be alone, as patient dredging failed to secure more.

Our two common species of *Ilybius*, *angustior* Gyll. and *confusus* Aubé are both fairly common at electric light in June, as is

also *Hybiosoma bifarius* Kby. They are all also taken by dredging in muddy, weedy situations.

So far, I have never succeeded in finding any of our species of Agabus at all commonly in their real homes. One spring several species were quite plentiful in ditches connecting with the streams running into the Red River. The water was very high, and apparently beetles which had passed the winter in the river were on their way, together with a number of fish, to find a suitable summer resort. At any rate, many of these slow-running ditches were swarming with beetles. I took several hundreds, most of which went to Mr. Roberts.

Of *Rhantus* we take *notatus* Fab. commonly both at electric light and in muddy ponds; *bistriatus* Bergst. and *tostus* Lec. are much less frequently met with. *Binotatus* Harr. has been taken by Mr. Criddle, who also records *Colymbetes strigatus* Lec. The common *Colymbetes* with me is *sculptilis* Harr., which often swarms at electric light. Mr. Roberts tells me that *rugipennis* Sharp. is a good species, and divided mine for me, but I don't know just on what characters, and my eye is not sufficiently trained at present to detect the differences.

Dytiscus is fairly well represented in Manitoba, as we certainly take six species. *Circumcinctus* Ahr. easily distinguished by the yellow circle around its eyes, is our commonest species, with *sublimbatus* Lec. running it pretty close. Both come to light in thousands. *Fasciventris* Say., *hybridus* Aubé., *dauricus* Gebl. and *harrisii* Kby. are all rather rare, especially the two former. An interesting point about our *dauricus* is that the specimens taken in Winnipeg at light all are small, while several taken at Winnipeg Beach, fifty miles away, are nearly double the size. Possibly the larvæ of Winnipeg specimens live in the Red River and fail to secure sufficient food.

Our rarest *Graphoderes* is *liberus* Say. and *fasciatocollis* Harr. is almost equally so. We take *perplexus* and *elatus* Sharp. more frequently than *fasciatocollis*. I believe Mr. Roberts considers these all good species, and indeed even I could separate them! Our commonest species is *occidentalis* Horn., which comes freely to the lights. It is also by no means uncommon in weedy ponds.

The list of our *Hydrophilidæ* is both short and unsatisfactory; the latter because so many species are in doubt. Our two largest species, *Hydrophilus triangularis* Say. and *Hydrocharis obtusatus* Say., are common at light, and the latter is frequently taken by dredging. Two or three species of *Helophorus* and *Hydrochus* may be found in every slough or ditch among weeds or decaying vegetation. Strangely enough, however, I have never taken *Helophorus tuberculatus* Gyll. except on the wing.

Berosus striatus Say., *Philhydrus bifidus* Lec. and *hamiltoni* are all common, one or more of these species appearing in almost every wet situation.

In conclusion, I should like to express my gratitude to Mr. C. H. Roberts, Mr. Chas. Liebeck and Dr. H. C. Fall for the generous and ready assistance they have given me by identifying my material.

THE RE-DISCOVERY OF AGRION INTERROGATUM, SELYS.

BY E. M. WALKER, TORONTO.

In the "Synopsis des Agrionines" (Bull. Acad. Royale Belg. (2) XLI, 1876, p. 1254) Selys described *Agrion interrogatum* from a single female taken in "Saskatchewan, Hudson Bay Territory." The description is a translation from Hagen's manuscript and the type specimen is in the Hagen collection at the Museum of Comparative Zoology, Cambridge, Mass.

Since this description was published, 39 years ago, this species has not been noted, and there seemed but little possibility of its ever being recognized with certainty from the description, as the latter was based upon a single female, the last seven abdominal segments of which were missing.

During a trip to the Pacific Coast, in 1913, I spent two days at Nipigon, Ont., and here I captured a pair *in coitu* of an entirely unfamiliar *Cœnagrion* (=*Agrion* Auctt.) and soon afterwards I took another female. These were all I saw of this species until the following year, when I came across it again at Spruce Brook, near the west coast of Newfoundland. They were very scarce and I succeeded in taking only four males in all.

A comparison of my female specimens with the description of *interrogatum* shows conclusively that they belong to this species, for the description, as far as it goes, is quite detailed, and the colour-pattern distinct enough to be unmistakable. As this description, however, was based upon an imperfect specimen, and as the male was hitherto unknown, I have prepared the following descriptions of both sexes.

Male—Face, including anterior margin of frons to base of antennæ, greenish; postclypeus and a heavy line at base of labrum black; postocular spots bluish, of moderate size, pyriform or subtriangular, the inner angles acute; a narrow blue occipital margin, which may be interrupted; underside of head black, with a rather broad, yellow, ocular margin; basal part of maxillæ piceous, labium pale yellowish.

Prothorax black, margined in front and behind with bluish, pleura with 3 or 4 irregular blue spots just above the fore-coxæ; hind margin broadly curved or subobtusangulate, moderately elevated except at the median line. Thorax bronze-black with azure blue markings.Antehumeral bands divided into an anterior, stripe and a posterior spot, the former slightly incurved in front, broader in the middle than half the mid-dorsal black stripe, the anterior ends truncate and slightly expanded, posterior ends abruptly rounded; the posterior spot rounded or oblong. Sides of thorax with a blue spot above each coxa and two large blue areas separated at the second suture by a heavy black line which is widened just behind the stigma and again at the upper end. The anterior blue area is partly divided above by a short black line, is excavated antero-ventrally and has three postero-ventral concavities, the middle and upper ones corresponding to the expansions of the black sutural line. Venter pale bluish, the sutures and the space between the middle and posterior legs heavily marked with black, and a heavy black band behind the posterior legs continuous caudad with the stem of a median Y-shaped spot. Legs bronze-black, the inner half of the femora and the outer half of the tibiæ pale greenish.

Abdomen bronze-black, marked with azure-blue, as follows:

Segment 1 blue, dorsum with a transverse black spot occupying the basal third or two-fifths, narrowly continuous on the

sides with a large angular or V-shaped black spot, the anterior limb of which is oblique, the posterior limb transverse. Venter pale with a dark ventral spot, more or less whitish-pruinose.

Segment 2 blue with a very broad oblong black patch on each side, their truncate anterior ends narrowly separated from, or united with, a black spot in the antero-ventral angle, their posterior ends connected across the dorsum, behind middle of segment, by a narrower black band, and prolonged ventro-caudad into a narrow streak which joins the apical transverse black band. Accessory genitalia piceous, the anterior hamuli with pallid margins.

Segment 3 blue; a long black streak on each side, close to the tergal margin, extending cephalad nearly to the base and united behind across dorsum by a basal black band, which is prolonged cephalad on the median line into a slender tapering streak. There is a black spot at the antero-ventral angle and a blue spot close to the postero-ventral angle. Venter black.

Segment 4: The black distal area covers about three-fifths of the segment, separated from the tergal margin by a narrow pale streak and prolonged cephalad on each side into a tapering submarginal streak which nearly reaches base of segment. There is a black dot near the antero-ventral angle and a small blue spot at the postero-ventral angle. Venter black.

Segments 5 and 6 black, the blue reduced to a basal ring occupying two-sevenths (seg. 5) or one-fifth (seg. 6) of the dorsum, and a lateral margin, in which broken indications of a black lateral streak may be present; a black dot at the antero-ventral angle. Venter black.

Segment 7 black with a narrow basal and a broader apical blue ring connected by a rather broad marginal band, which generally encloses an irregular black streak, though the latter may be united with the black of the dorsum.

Segments 8 and 9 blue, each with a black lateral dot; segment 9 also with a pair of black dorsal dots.

Segment 10 black above, blue beneath and on the sides.

Wings—Postcubitals of front-wings 10, sometimes 9; of hind-wing 8, occasionally 9. M_2 in front-wing arising opposite the

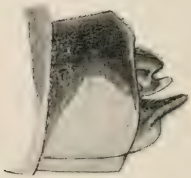
1

2

3

4

5



6

CŒNAGRION INTERROGATUM (SELYS).

fourth postcubital or between the fourth and fifth; the hind-wing between the third and fourth, generally near the fourth; pterostigma covering less than one cell, dark sooty brown with a narrow pale margin.

Appendages—Superior appendages bifid, the upper part short, stout, piceous, separated by a constriction from the lower part, which is somewhat longer and in profile more slender, terminating in a pale tubercle. In dorsal view the upper part has the form of a stout incurved hook, the pale tubercle is continued along the mesial surface nearly to the base and has a slightly concave inner edge bearing a minute sub-basal tubercle. Beneath it the appendage is produced into a slender recurved and incurved hook-like process.

Inferior appendages consisting of an outer piceous and an inner pale portion. The piceous part consists of a broad subtriangular base and a slender apical process directed somewhat upwards, incurved at the tip, and projecting beyond the pale portion, which appears beneath it in profile view, and is mesially concave.

Female—The pale markings of one of the females are blue, of the other salmon-coloured. The former was taken *in coitu* with the single male from the same locality. The colours of the other female had apparently not quite matured and are evidently faded.

The markings of the head and thorax are similar to those of the male with the following slight differences: Postocular spots somewhat larger and rounder, transverse occipital line somewhat broader, pale lateral spots of prothorax slightly larger, tending to merge together; long portion of antehumeral bands straight and not widened in front. In the specimen taken *in coitu* the anterior pale area on the sides of the thorax is divided into two by an extension of the black line which arises at base of front wing. (Pl. V, fig. 4.)

The abdomen is marked as follows:—

Segment 1—Similar to the male, but with transverse dorsal black spot occupying anterior half of segment, lateral spot divided.

Segment 2—A median dorsal black spot, consisting of a narrower anterior part, which is continued cephalad as a narrow line, and a much broader transverse posterior part, connected behind with an apical ring. There is also a black lateral streak, extending the entire length of the segment close to the tergal margin and widened posteriorly

Segments 3 to 6—Bronze-black above, with a pale basal ring; the black area occupies the dorsal half of the segment and is more or less widened, especially on seg. 3, near the hind margin, where it is narrowly connected with a black submarginal lateral streak extending the entire length of the segment, widening at point of contact with the black dorsal area. A small pale spot is thus enclosed behind this point of contact. The pale basal ring is of about the same width on segments 3 to 5, narrowing somewhat on seg. 6.

Segment 7—Similar, but the pale basal ring still narrower, a very narrow pale apical ring and the lateral streak not quite meeting the dorsal black area except at the apical black ring.

Segment 8—Basal two-thirds to four-fifths black above, apical portion pale, continuous with the pale colour of the sides, in which a long black streak is enclosed.

Segment 9—Basal two-thirds of dorsum with a black subquadrate spot, sides pale with a blackish patch.

Segment 10 and appendages wholly pale.

Sternites of segs. 1 and 2 pale, black-margined; all of the other segments, except apical margin of 8, black. Ovipositor pale.

In one of the females there are 10 postcubitals in each front-wing and 8 in each hind-wing; in the other there are 10 postcubitals in one front-wing, 11 in the other, and 9 in each hind-wing. In both specimens vein M_2 arises just before the fifth postcubital in the front-wings and just before the fourth postcubital in the hind-wings.

Length of body, ♂ 28-30 mm., ♀ 31-33 mm.; abdomen ♂ 22.5-25 mm., ♀ 25-26 mm.; hind-wing, ♂ 16.7-17.8 mm., ♀ 19.5-19.75 mm. The Nipigon male measures about the same as the largest male from Newfoundland, but is distinctly more slender than any of the Newfoundland specimens. A similar difference

is seen in other species of dragonflies and is apparently dependent upon climatic conditions.* There are no other differences worthy of note, except possibly the somewhat shorter interruption of the antehumeral thoracic bands, the posterior spots being more elongate and less rounded.

Selys placed *A. interrogatum* doubtfully as a race of the palæarctic *A. concinnum*, with the following statement concerning its differential characters (l. c., p. 1254).

"1° Les taches postoculaires un peu dentelées en arrière;

"2° Les raies antéhumérales interrompues en point d'exclamation.

"3° La tache basale carrée du 2e segment non prolongée jusqu'au bout, et la bande dorsale des 2e et 3e amincie en avant."

I have not seen *concinnum*, but from a comparison of my specimens of *interrogatum* with Selys' description, I think it improbable that the two forms are conspecific though evidently closely related. In *concinnum* the antehumeral bands are entire, but narrowed above, while in *interrogatum* they are sharply divided, but not narrowed. In the male of *concinnum* the transverse band on segment 2 is described as being connected by a stalk with the apical ring, while in *interrogatum* this connection is not present. Segments 3-5 are described as being black in the apical half, whereas in *interrogatum* the black area includes considerably less than half of segment 3, and more than two-thirds of segment 5. The apical blue area of segment 7 in *interrogatum* is not mentioned in the description of *concinnum* and instead of a black dot on the sides of segments 8 and 9 a black line is described as present. The description of the female does not reveal any differences not noted by Selys.

Hagen compares *interrogatum* with his so-called variety *servum* of *C. resolutum*. This is a form in which the antehumeral bands are divided, resembling an exclamation mark. It is the normal form in Newfoundland, but is hardly worthy of a varietal

*I have discussed this subject as it relates to the genus Aeshna in "The North American Dragonflies of the genus Aeshna" (Univ. Toronto Studies, Biol. Series, No. 11, pp. 25-29, 1912).

name. *Resolutum* is abundantly distinct from *interrogatum*, but is more closely related to it than is *C. angulatum*, the only other North American species of *Cœnagrion*.

These three species of *Cœnagrion* may be separated as follows:

A. Venter of thorax wholly pale; abd. segs. without lateral black streaks close to the tergal margins; seg. 1 without lateral black markings (except a fine transverse line near apical margin).

a. Underside of head black, with a broad yellowish ocular margin; without a pale occipital marginal line; seg. 2 in the male with a transverse black spot, not connected with the apical black ring; seg. 8 of female with a pale basal ring ..... *angulatum* Walk.

aa. Underside of head yellowish; a pale marginal occipital line; seg. 2 of male with a black dorsal spot connected by a stalk with the apical black ring; seg. 8 of female without a pale basal ring ..... *resolutum* (Selys)

AA. Venter of thorax with a transverse black band behind the posterior legs, connected with a Y-shaped spot; some of the abd. segs. with black lateral streaks close to the tergal margins; seg. 1 with an oblique or angular black lateral spot..... *interrogatum* (Selys)

The three specimens of *C. interrogatum* from Nipigon, Ont., were taken on June 19, 1913, from a marshy clearing on the shore of the Nipigon River. Three of the Newfoundland specimens were captured on July 27, 1914, in an open marsh at the mouth of a small trout stream emptying into a small lake. The other was taken on July 29 in a small reedy marsh, bordering a small lake, surrounded by dense woods. Both of these lakes are mere expansions of small streams, abounding with brook trout. Dragonflies were exceedingly scarce here, in spite of apparently favorable conditions. This was perhaps due to the great numbers of trout present.

EXPLANATION OF PLATE V.

Cœnagrion interrogatum (Selys).

Fig. 1.—Male, dorsal view. Nipigon, Ont.

Fig. 2.—Male, lateral view. Spruce Brook, Newfoundland.

Fig. 3.—Female, dorsal view. Nipigon, Ont.

Fig. 4.—Female, lateral view. Nipigon, Ont.

Fig. 5.—Male, abdominal appendages, dorsal view. Spruce Brook, Newfoundland.

Fig. 6—Male abdominal appendages lateral view. Spruce Brook, Newfoundland.

AN INSECT ENEMY OF THE FOUR-LINED LEAF-BUG (*PŒCILOCAPSUS LINEATUS* FABR.)

BY C. R. CROSBY AND ROBERT MATHESON, ITHACA, N.Y.

On July 26, 1913, while examining some stems of Weigelia containing the eggs of the four-lined leaf-bug we discovered that the lower end of many of the eggs had been eaten into and the contents extracted by a small hymenopterous larva. The larva burrows through the pith until it reaches a row of eggs and then

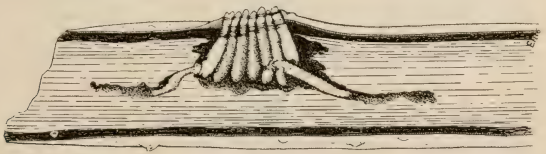


Fig. 14.—Larvæ of *C. ovisugosus* attacking eggs of the Four-lined Leaf-bug.

proceeds to destroy them one after another until three or four eggs have been eaten (Fig. 14). Frequently two larvæ may attack the same row of eggs working from opposite ends and thus destroy the entire egg mass. From an examination of a large number of egg masses in this clump of Weigelia about 50% were found to be attacked by this parasite.

The larvæ reach maturity before cold weather but do not pupate until the following spring. In order to secure adults we collected a large number of egg masses on February 28, 1914, and found the small larvæ snugly occupying cavities in the pith

near the eggs. Sometimes the larvæ retreat a short distance from the egg mass burrowing through the pith. These larvæ pupated about a week later and the adults emerged on March 23. This parasite is apparently undescribed. It is a chalcid and belongs to the genus *Cirrospilus*.

Cirrospilus ovisugosus sp. nov.

Female—Length 1.84 mm. Head brown below with a faint bluish-metallic reflection in front and above. Thorax seen from above brilliant iridescent green, blue in certain lights. Prothorax on the sides and the prosternum similar in colour. Abdomen seen from above with metallic greenish reflections, becoming brownish in front, the greater part of the first segment straw colour.

Meso- and metapleura and coxæ dull brown, almost black. Remainder of the legs straw colour, nearly white. Under surface of abdomen brownish, pale at the base, with slight metallic reflections towards the tip.

Fig. 15.—*Cirrospilus ovisugosus*, male

Antennæ straw-coloured to brownish. Scape slender, pedicel obconic, ring-joint minute. Funicle with three segments, the first the longest, the second and third subequal. Club pointed, indistinctly three-segmented.

Male—Length 1.4 mm. (Fig. 15). Head yellow, eyes and ocelli red. Thorax and legs similar to that of the female.

Abdomen with the first and nearly all of the second segments straw colour, the remainder dark brown with coppery metallic reflections.

Antennæ pale straw colour. The scape greatly enlarged,

narrowed at the base and broadening at the tip. It is about one-third the length of entire antenna. Pedicel obconic, as long as the first segment of the funicle. Ring joint minute. Funicle 4-segmented, the first slightly longer than the others, the second, third and fourth subequal. Club pointed, about one-half as long as the funicle, distinctly 3-segmented when seen in alcoholic specimens.

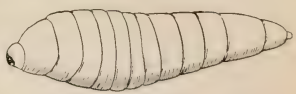


Fig. 16.—*C. ovisugosus*, larva.

Fig. 17.—*C. ovisugosus*, pupa.

Larva—Length 1.7 mm.; white with brownish jaws (See figure 16).

Pupa (newly transformed.)—Length 1.5 mm. Colour creamy white. At the base of the abdomen on the dorsal side is a large, oval, orange-coloured area extending on the thorax, apparently caused by the ingested food (Figure 17).

Described from 4 male and 1 female specimens, Ithaca, N.Y., March 23, 1913. Types in Cornell University Collection.

CARNIVOROUS HABITS OF *XYLINA BETHUNEI*; G. AND R.*

BY GEORGE E. SANDERS, B.S.A.,
Field Officer Entomological Branch, Bridgetown, Nova Scotia.

In working with *Xylina bethunei* G. & R. the most common fruit worm or apple worm in Nova Scotia at the Dominion Entomological Laboratory at Bridgetown, N. S., in 1913, it was found that the best place to collect 5th and 6th stage larvæ was in the leaves about the cocoons of *Malacosoma disstria*. On opening a few of these cocoons the pupa contained were in some cases found to be partly eaten. A rough opening having been partly eaten and partly stretched through the cocoon from 1/3 to ¾ of the contained pupa had been devoured. Later on several larvæ were found in the act of eating into the cocoons or devouring the contained pupa. On July 8, 9, 10, 1913, 160 cocoons of *M. disstria* were collected from apple trees near the laboratory and 45 of

*Contribution from the Entomological Branch, Department of Agriculture, Ottawa.
June, 1915

them or 28.12% were found to have been eaten into and destroyed by 5th and 6th stage *X. bethunei* larvæ. On July 12 and 13, of 1913, a collection of 201 *M. disstria* cocoons was made and 70 of them or 34.82% were found to be destroyed in the same manner. On July 12, 1913, 75 *Malacosoma americana* cocoons from apple at Deepbrook, N. S., were examined and 7 of them were found to have been destroyed by *X. bethunei* larvæ. In 1913 *X. bethunei* was no further advanced than *M. disstria* and so was a considerable factor in the control of the latter on apple. In 1914 *M. disstria* was almost as numerous as during the previous season, and was greatly retarded by the season, as were apple trees on which it was feeding. *X. bethunei* was not so numerous in 1914 as in 1913, and for some reason was not very much retarded by the season, consequently most of them had pupated before the *M. disstria* larvæ spun up their cocoons so the percentage killed by *X. bethunei* was much less than during the season of 1913. Of 217 cocoons of *M. disstria* collected from apple on July 17, 1914, only 13 or 5.99% were eaten by *X. bethunei*.

THE ENTOMOLOGICAL SOCIETY OF ONTARIO.

The Forty-fifth Annual Report of the Entomological Society has just been issued by the Ontario Department of Agriculture, Toronto. The President's address is a valuable contribution to the history of applied entomology in Canada, by Provinces. The insects of the year (1914), both in Ontario and Quebec, are described by several observers, and valuable suggestions are given as to their control. Among the other practical papers presented are those dealing with "The Army Worm in 1914," Experiments with Poisoned Bait for Locust Control," "An Imported Red Spider Attacking Fruit Trees," and "Control of Forest and Shade Tree Insects of the Farm." The more purely literary contributions comprise a very discerning biographical sketch of the celebrated French entomologist, Jean Henri Fabre, and a chatty article on "Mountains and Hills." The Entomological Record for the year is, as usual, most complete and informing. The many illustrations are a valuable feature of the report, a copy of which will be sent to any entomologist upon application to the Department.—(Press Bulletin, Ont. Dept. of Agriculture.)

THE PUPAL INSTAR OF THE FRUIT-TREE LEAF-ROLLER (*ARCHIPS ARGYROSPILA*[1]).

BY GLENN W. HERRICK AND R. W. LEIBY, ITHACA, N. Y.

For the past three years the fruit-tree leaf-roller has been exceedingly abundant in New York State and has caused serious losses to fruit growers. The senior author has given all the time that could be spared from his University duties to the fight against this pest, and during the spring of 1914 it was determined to prosecute the fight on a wider scale, according to plans that naturally grew out of the knowledge that had been gained in past seasons. Accordingly the junior author was established in a field laboratory in Western New York among orchards seriously infested. As a part of the work, it was determined to study certain phases of the life history of the leaf-roller that had not been satisfactorily cleared up before, and one of these points was that of the length of the pupal period. This had become especially desirable in view of the interesting data secured by Davidson in California.[2] In Bulletin 311 of the Cornell Station, written by the senior author, it was stated that the pupal instar under insectary conditions varied from nine to twelve days. This statement was based on a relatively small number of pupæ, whose actual instars were determined. It seemed desirable to observe a much larger number of the pupæ under as natural conditions as possible in order to obtain a more general average.

Large numbers of the larvæ, nearly full-grown, were placed in jars with an abundance of fresh food. These jars were in an open-air insectary and under normal conditions of temperature. Every morning about the same hour the jars were carefully examined and each newly-transformed larva removed. During the first part of the work each pupa was placed in a separate vial, with muslin over the top, and its record of transformation to the moth kept separate. Later, all of the pupæ gathered on any one morning were placed in a lantern globe, together with some leaves, and muslin was then tied over both ends of the globe. This arrangement gave a clear circulation of air and maintained probably nearly normal conditions of temperature and air drainage. As the moths emerged, each one was removed and the date recorded. The following table shows graphically the results of the study:

1. Contribution from the Department of Entomology at Cornell University.
2. Jr. Ec. Ent., Vol. 6, p. 396.

PUPAL INSTAR OF *ARCHIPS ARGYROSPILA*.

Number of Specimens	Date of Pupation	Date of Adult Emergence	Length of Instar	Total Days
1	June 10	June 20	10 days	10
4	" 10	" 23	13 "	52
2	" 10	" 24	14 "	28
1	" 10	" 25	15 "	15
1	" 11	" 20	9 "	9
1	" 11	" 21	10 "	10
1	" 11	" 23	12 "	12
5	" 11	" 24	13 "	65
3	" 11	" 25	14 "	42
2	" 11	" 26	15 "	30
1	" 12	" 23	11 "	11
2	" 12	" 26	14 "	28
5	" 13	" 23	10 "	50
3	" 13	" 24	11 "	33
4	" 13	" 25	12 "	48
6	" 13	" 26	13 "	78
5	" 13	" 27	14 "	70
4	" 13	" 28	15 "	60
4	" 14	" 24	10 "	40
4	" 14	" 26	12 "	48
4	" 14	" 27	13 "	52
2	" 14	" 28	14 "	28
3	" 14	" 29	15 "	45
2	" 14	" 30	16 "	32
3	" 15	" 26	11 "	33
8	" 15	" 27	12 "	96
9	" 15	" 28	13 "	117
2	" 15	" 29	14 "	28
2	" 16	" 26	10 "	20
1	" 16	" 27	11 "	11
8	" 16	" 28	12 "	96
9	" 16	" 29	13 "	117
2	" 16	" 30	14 "	28
1	" 16	July 1	15 "	15
1	" 17	June 28	11 "	11
4	" 17	" 29	12 "	48
6	" 17	" 30	13 "	78
3	" 17	July 1	14 "	42
1	" 18	June 27	9 "	9
2	" 18	" 29	11 "	22
4	" 18	" 30	12 "	48
5	" 18	July 1	13 "	65
1	" 18	" 2	14 "	14
1	" 19	June 29	10 "	10
2	" 19	" 30	11 "	22
6	" 19	July 1	12 "	72
3	" 19	" 2	13 "	39
1	" 19	" 3	14 "	14
1	" 20	June 30	10 "	10
1	" 20	July 1	11 "	11
4	" 20	July 2	12 "	48
7	" 20	" 3	13 "	91
2	" 20	" 4	14 "	28
1	" 20	" 5	15 "	15
1	" 21	" 2	11 "	11
3	" 21	" 3	12 "	36
5	" 21	" 4	13 "	65
2	" 21	" 5	14 "	28
1	" 21	" 6	15 "	15
5	" 22	" 4	12 "	60
5	" 22	" 5	13 "	65
1	" 22	" 6	14 "	14
1	" 23	" 3	10 "	10
10	" 23	" 5	12 "	120
9	" 23	" 6	13 "	117
1	" 23	" 7	14 "	14
2	" 23	" 8	15 "	30
1	" 24	" 5	11 "	11
3	" 24	" 6	12 "	36
5	" 24	" 7	13 "	65
1	" 24	" 8	14 "	14
Total Pupae.....227				2865

Average Length of Pupal Instar, 12.6 days.

It will be seen from the table that 227 pupae were under observation and that the minimum length of the pupal instar was 9 days and the maximum length 16 days, while the average was 12.6 days.

During the first part of the investigation no data were kept on the sexes, but in the later stages of the observations determinations of sex were made in case of the last 155 individuals, of which 70 were females and 85 males. No data, however, were secured on the pupal instars of the two sexes separate from each other. The average of 12.6 days, therefore, is that of males and females combined in probably about the proportions shown by the foregoing figures concerning the last 155 individuals.

The maximum and minimum temperatures, obtained from the Weather Bureau at Rochester, N. Y., are given for each day covering the period of the experiment. Our own maximum and minimum thermometer was evidently placed in a position which did not give the normal temperatures, and we, therefore, took the records of the Rochester Observatory. Rochester is eighteen miles southeast of Hilton, where the field laboratory was situated, and the temperature conditions at the former city would probably fairly represent those obtaining at Hilton, although the altitude of Hilton is 284 feet, while that of Rochester is 523 feet. At any rate, they would be more representative than the temperatures recorded by our own thermometer under the apparently abnormal conditions in which it was placed.

The difference in the length of the pupal instar as recorded in California by Davidson and in New York as shown by the foregoing data is interesting. More data, however, on meteorological conditions in the two regions will be necessary before any very definite conclusions may be drawn.

TEMPERATURES FOR PERIOD OF EXPERIMENT*

June	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Maximum	84	83	74	73	65	70	62	76	84	75	64	66	70	84	92
Minimum	67	63	59	50	52	51	49	44	56	45	41	54	57	64	69
June	25	26	27	28	29	30	July 1	2	3	4	5	6	7	8	9
Maximum	84	79	73	81	64	74	73	71	73	80	79	79	80	85	82
Minimum	62	56	58	57	53	52	54	60	58	58	62	61	66	64	65

*From the Records of the Weather Bureau at Rochester, N. Y.

NEW GENERA AND SPECIES OF TINEINA.

BY ANNETTE F. BRAUN, CINCINNATI, O.

Several species of Tineid moths in the writer's collection belonging to genera apparently new are of considerable interest because of their phylogenetic significance or because they show relationship to isolated genera or groups of genera. The present paper includes the description of these genera, together with descriptions of a number of new species recently bred. The types are in the writer's collection.

Corythophora, new genus.

Face smooth; head elongate, with an erect tuft between the antennæ. Antennæ 4/5, basal segment enlarged and concave beneath to form an eye-cap, with pointed projecting flap of scales anteriorly. Labial palpi moderate, drooping, smooth-scaled. Maxillary palpi rudimentary.

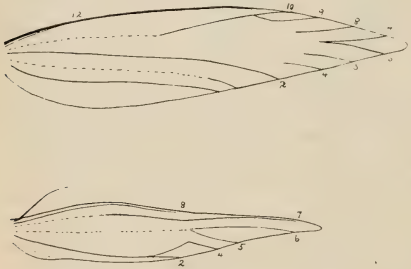


Fig. 18.—Venation of *Corythophora aurea.*

First segment of anterior tarsi thickened with scales; posterior tibiæ hairy.

Fore wings elongate ovate, costa thickened for two-thirds its length; 1b simple, 3 absent, 6 and 7 connate, 9 and 10 arising near costa, 11 absent; transverse vein absent between 2 and 9. Hind wings 2/3, narrow, lanceolate, cilia 4; 3 absent, 5 and 6 stalked, transverse vein absent between 4 and 5. (Fig. 18).

Type—*Corythophora aurea.*

The relationship of this genus to *Leucoptera* Hb., *Crobylophora* Meyr., and *Proleucoptera* Busck., is suggested at once by the general appearance of the insect, and a study of all the characters substantiates this view. It is a much earlier form and undoubtedly indicates the stem from which the genera of this group have sprung.

although the genus in its present form has acquired a number of specialized characters.

The neuration of the fore wings in the three genera just mentioned can easily be derived fron that of *Corythophora*. The absence of vein 11 is not significant, but is of recent disappearance, as it is virtually absent in one species of *Proleucoptera* while present in the other, and thus can not be considered as a character of importance. However, the fact that vein 4 is here present and occupying its normal position would suggest that a slightly different interpretation should be put upon the venation of *Proleucoptera*, viz., that vein 3 is absent and not 4, as stated by Mr. Busck in his characterization of that genus.

The derivation of the neuration of the hind wings of the younger genera from this type is not so obvious. However, the examination of the hind wing of *Proleucoptera smilaciella* Bsk. discloses a feature hitherto overlooked, which shows clearly its origin from the present genus. As shown in the accompanying figure (Fig. 2), veins 5 and 6 are stalked from the base and distinctly separate from 7 toward base, but almost anastomose with it along the middle of the wing, becoming separate again where they branch.

Its affinities with Tineid stock are at once apparent; in fact, its neuration closely approaches that of some of the Tineid genera. This furnishes strong confirmatory evidence of the descent of this group from the Tineidæ, from which it has been regarded as derived.

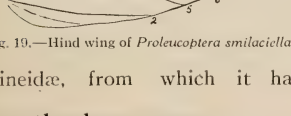


Fig. 19.—Hind wing of *Proleucoptera smilaciella*

Corythophora aurea, n. sp.

Head and appendages very pale yellow, flap of scales on basal segment of antennæ somewhat deeper yellow.

Thorax pale yellow or white, patagia golden yellow. Fore wings golden yellow, deepening toward the apex, where the colour is deep orange. Costal margin from 1/5 to just beyond the beginning of the cilia, and dorsal portion of the wing below the fold, pale yellow, fading almost to white on the extreme margins.

Legs pale yellowish white, except the anterior tibiæ and tarsi, which are dark brown externally.

Expanse: 9-9.5 mm.

Two males, Cincinnati, O., July 13, and Balsam, N. C., July 22.

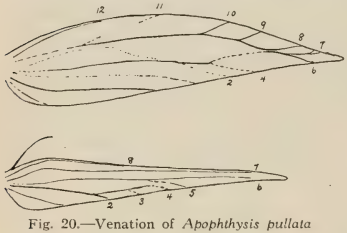


Fig. 20.—Venation of *Apophthysis pullata*

The erect tuft and position of the antennal flaps which project obliquely forward in the dead insect give this species a very striking appearance.

Apophthisis, new genus.

Head with appressed scales, antennæ somewhat under 1, basal segment with pecten. Labial palpi moderate, straight, drooping. Maxillary palpi rudimentary.

Posterior tibiæ with a row of short projecting scales above.

Fore wings lanceolate, the margin from the inner angle to the apex is almost straight or slightly concave; 2 almost obsolete, 3 absent, 4 indistinct, from lower angle of the cell, 5 absent, 6 and 7* stalked, transverse vein indistinct between 4 and 6, 11 obsolete except at origin and near costa. Hind wings about ½, lanceolate, cillia 5; 5 and 6 stalked. (Fig. 20).

Type: *Apophthisis pullata.*

A very peculiar genus, apparently most closely allied to *Stomphastis* Meyr., with which it agrees in some characters. The loss of vein 5 of the fore wings is a feature not found elsewhere in the *Gracilariadæ*, where modification usually results in the loss of vein 6.

In any group it is possible within certain limits to determine which veins are absent, if the primitive type of colour pattern is known. Elsewhere† it was shown that the tips of veins mark the extremities of unpigmented (white) fasciæ, separating the primitive transverse bands of colour. Thus, in *Lithocolletis*, the primitive colour pattern consists of a series of seven transverse bands, separ-

*In the specimen denuded, 7 is branched near the costa, as shown in the figure; this is probably an individual abnormality.

†Braun. Evolution of the colour Pattern in the Microlepidopterous Genus Lithocolletis, Jn. Acad. Nat. Sci. Phila., XVI, 105-167, 1914.

ated from one another by white fasciæ. The last of these bands crosses the tip of the wing. The costal extremity of the white fascia preceding it lies over the tip of vein 7, but there is no vein at its extremity on the termen. The extremities of the sixth band lie between veins 7 and 9 on the costa, and just beyond vein 5 on the termen. The white fascia preceding this band lies over the tip of 9 on the costa, and over the tip of 5 on the termen. This general type of colour pattern may be regarded as primitive not only for *Lithocolletis* alone, but for the entire family *Gracilariadæ*. In more ancestral forms, where all the veins are present, the tip of vein 6 occupies the position marked by the extremity of the last white fascia, that is it is almost opposite the tip of vein 7. This must be regarded as the normal position for vein 6 in this group. Therefore, in *Lithocolletis*, where no vein is present at the extremity of this fascia on the termen, we must regard vein 6 as the vein which is absent, as has been done in the more recent literature on the group.

In *Apophthisis*, the last vein to reach the termen before the apex occupies the normal position of vein 6. For this reason, vein 5 has been here regarded absent, in a group where it is, with this exception, uniformly present.

Apophthisis pullata, n. sp.

Head and palpi gray, antennæ gray with paler annulations. Fore wings clothed with sordid grayish white, fuscous-tipped scales, giving the wing in general a speckled gray appearance. An indistinct black streak in the fold from near base to one-third, a second shorter streak in the fold beyond it. The scales around the apex form an indistinct line in the gray cilia. Hind wings gray.

Legs gray; tibiæ tipped with white; tarsi annulate with white.

Expanse: 5.5-6 mm.

Two specimens, both males, near Cincinnati, O. The larva is a miner in leaves of buckthorn (*Rhamnus lanceolata* Pursh.) The mine lies deep in the leaf substance; linear at first, gradually broadening into an irregular blotch, 5 or 6 mm. wide, and occupying about one-fourth of the area of the leaf. The leaf retains its green colour, so that the mine is not plainly visible during the

early stages; in the later portions of the blotch, the substance of the leaf is consumed, rendering the mine distinct. Pupa outside the mine in broadly oval, flat, yellow cocoon spun in a fold of the leaf or in a crevice.

There are two generations a year. Mines may be found in early July and in October. The two imagos in my collection appeared July 25 and May 1 respectively.

The position of the imago at rest reminds one of a small species of *Ornix*.

Marmara auratella, n. sp.

Head and thorax dark brown, with a distinct bronzy lustre; face metallic gray. Labial palpi bronzy, third segment with the apical half whitish. Maxillary palpi with the last segment pale. Antennæ dark brown.

Fore wings bronzy brown, with an almost golden lustre under brilliant illumination. The markings are brilliant silvery white and are situated as follows: At the basal fourth a fascia nearly straight on its inner margin, but broadening outwardly below the fold; at the middle of the wing a somewhat oblique costal streak, and nearly opposite it, but a little farther back on the dorsal margin, an erect dorsal streak; at the apical third a triangular costal streak almost meeting the apex of a similar dorsal streak; just before the tip a narrow costal streak, nearly crossing the wing. Cilia dark brown, shining white opposite the apex. Hind wings dark brownish gray, cilia concolorous.

Legs dark brown, with broad silvery annulations. Abdomen beneath with segments silvery posteriorly.

Expanse: 6.5 mm.

Two specimens, Cincinnati, O., bred from long serpentine mines on stems of the cultivated form of *Rudbeckia laciniata* L., the "Golden Glow "of gardens. I have searched for the mines on the stems of the wild plants, both here and elsewhere, without success. The mine, which is very similar to that of *Marmara salictella* on willow, is usually situated toward the lower part of the stem. The larva mines just beneath the epidermis usually working downwards, although the mine crosses on itself many times.

At the time of pupation the larva departs widely from the well-known habits of all the other species of the genus. Previous to this time the mine has been placed just beneath the epidermis. At maturity the larva cuts through the epidermis and two layers of bark beneath it around the end of the mine and for a distance of 3 or 4 mm. on each side. This elongate flap of tissue which hangs with its free end downward is then bent into a fold which causes it to project beyond the contour of the stem. The cocoon is spun on the under side of the flap, so that its lower surface is visible if the flap is lifted up. At the anterior end of the cocoon a slit is cut in the lower layer of loosened bark and through this opening a passage lined with silk leads to the exterior, so that at emergence the pupa is thrust out between the two layers of loosened bark at the lower end of the flap. The pearly globules, so characteristic of the cocoons of the other species of the genus, are entirely absent in this instance. In other respects this species agrees with the characteristics of the genus.

There are two generations a year. The larvæ of the first generation pupate toward the end of July and produce imagos in early August. The larvæ of the second generation pupate in October, but the imagos do not appear untill the first of the following June.

The imago is nearest to *M. arbutiella* Bsk.

Marmara apocynella, n. sp.

Head whitish on face, becoming distinctly yellowish on the vertex, with some fuscous scales behind. Palpi whitish, the second segment of the labial palpi tipped with black. Antennæ gray.

Fore wings black; a straight white fascia at basal fourth; an oblique fascia at the middle, a little angulated near the dorsum; at two-thirds, a triangular costal spot and opposite it a small inconspicuous dorsal spot; a white costal streak before the apex. Cilia white opposite the apex, elsewhere gray. Hind wings and cilia gray, tinged with yellow.

Legs black, annulate with white; first tarsal segment black with a white tip, remaining segments pure white with an occasional black spot near the tip. Abdomen black above, grayish beneath.

Expanse: 5 mm.

One specimen, bred from a long whitish serpentine mine on the stem of dogbane (*Apocynum cannabium* L.). The larva leaves the mine to pupate, and spins the characteristic white cocoon ornamented with pearly globules. Mine collected near Cincinnati. July 3, at which time the larva was nearly full grown. Imago, July 21.

This species comes very close to *Marmara salictella* Clem., from which it may be distinguished by the yellow head, more oblique median fascia and smaller size.

Cystiœcetes, new genus.

Head with appressed scales; ocelli present; tongue developed. Antennæ 2/3, outer half very shortly bipectinate and ciliate in both sexes, basal segment rather long, without pecten. Labial palpi long, recurved, second segment thickened with scales, terminal segment shorter, thickened with scales, apex acute. Maxillary palpi very short, appressed to tongue.

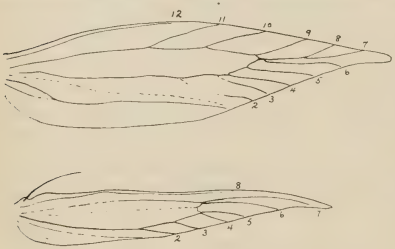


Fig. 21.—Venation of *Cystiœcetes nimbosus*.

Posterior tibiæ rough-haired above on the posterior half.

Fore wings with large tufts of raised scales; 1b furcate, 2 from three-fourths of cell, tubular only near the margin, 4 from angle, 6 out of base of stalk of 7+8, 11 from middle of cell. Hind wings 2/5, narrow lanceolate, cilia 5; 2 - 4 nearly parallel, 4 and 5 connate, 5 and 6 parallel, 6 and 7 approximated at base. (Fig. 21).

Type: *Cystiœcetes nimbosus*.

This genus is closely related to *Chrysopeleia* Cham., which it very closely resembles in type of markings; the antennal and palpal characters are identical. In *Chrysopeleia* vein 2 of the fore wings is absent, and 6 is out of 7 beyond 8; the venation of the hind wings differs only in the stalking of 6 and 7. It appears to bear some resemblance to some Australian genera in antennal structure and in neuration of the hind wings.

Cystiœcetes nimbosus, n. sp.

Head gray; scales on the under surface of the palpi becoming white-tipped towards the ends of the segments. Antennæ dark gray. Fore wings gray, microscopically speckled with whitish. Scale tufts almost black, the scales composing them tipped with white; a large tuft below fold at basal third, another below the middle of the costa; a smaller tuft on the dorsum a little behind the middle; a fourth small tuft at end of cell; two very small tufts on termen before apex. Hind wings and cilia gray.

Legs dark gray, tips of segments whitish.

Expanse: 10.5-12 mm.

Thirteen specimens, Mills College, Alameda Co., Cal., and Camp Baldy, San Bernardino Co., Cal., bred from larvæ on "Cascara" (*Rhamnus purshiana* DC.), an evergreen, and also on a similar deciduous species of *Rhamnus*.

The larva feeds within a large inflated gall-like chamber formed from the two halves of the leaf, which are closely appressed above, just below the margins of the leaf, and near each end. The leaf bulges between the lateral veins forming a series of pouches projecting from the large elongate chamber. (Fig. 22). The larva is pale grayish brown, with head and prothoracic shield shining pale brown. A small silken cocoon is spun, often just outside the larval habitation, where the sides of the leaf diverge, or between leaves on the bottom of the breeding jar.

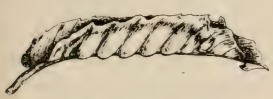


Fig. 22.—Larval dwelling of *Cystiœcetes nimbosus*

Antispila aurirubra, n. sp.

Head and palpi bronzy; antennæ dark brown. Thorax and fore wings very lustrous, colour varying, according to the direction of light from greenish golden to a brilliant reddish bronze. The latter colour predominates near the base and along the termen and around the apex of the wing. At one-third a narrow pale golden fascia, somewhat nearer base on the dorsum; at two-thirds a triangular costal spot, and a little nearer the base on the dorsum a similar dorsal spot, with its apex produced and pointing obliquely toward the middle of the costa. Cilia dark gray. Hind wings dark gray, purple toward the apex, with golden brown cilia.

Legs bronzy brown, hind tarsi tipped with pale yellow.

Expanse: 7-8 mm.

Two specimens, Fredalba, San Bernardino Co., Cal. Larva in brownish blotches in leaves of a species of *Cornus*. The completed case appears somewhat truncate at each end. Mines received, August 6; imagos emerged May 21 and 25.

More closely allied to *A. nyssæfoliella* than to any other species, but the more reddish colour and the more slender fascia will separate the two species.

Obrussa, new genus.

Head and face tufted. Antennæ 2/3, simple in ♂; basal segment enlarged and concave beneath to form an eye-cap. Labial palpi well developed, porrected. Maxillary palpi long, filliform, folded. Tongue rudimentary.

Posterior tibiæ with spines above; middle spurs above the middle of the tibiæ.

Fore wings elongate ovate; 1b simple at base, 2 becoming obsolete shortly beyond transverse vein, which closes the cell before the middle of the wing, 3 and 4 absent, 5 and 6 stalked, the stalk out of 8, 7 to costa out of 8, 9 absent. Hind wings a little over ½, cilia 2½; 1c faintly visible, 3 and 4 absent, 6 absent, 5 and 7 stalked from before middle, cell open between 2 and 5. Frenulum of many spines. (Fig. 23).

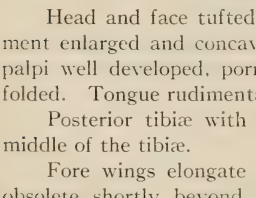


Fig. 23.—Venation of *Obrussa ochrifasciella*.

Type: *Obrussa ochrifasciella* Chambers (Can. Ent., V, 128, 1873.).

The genus seems to approach *Ectædemia* Bsk. more closely than any of the other allied genera; from *Ectædemia* it differs chiefly in the presence of vein 5 of the fore wings and in the position of the spurs of the hind tibiæ, which are situated above instead of below the middle. *Obrussa* is relatively somewhat shorter and broader winged than either *Ectædemia* or *Nepticula*.

In describing *Nepticula ochrifasciella*, Chambers probably had before him males only, which are uniformly smaller than females, and alone show the distinct ochreous under surface of the basal

half of the fore wings. A fuller description embracing both sexes is here given:

Palpi pale ochreous. Tuft on face and head reddish ochreous. Antennæ fuscous, eye-caps ochreous.

Thorax and basal third of the fore wings black, apical two-thirds tinged with brown. A broad pale ochreous fascia crosses the wing at the basal third. From base to outer edge of fascia on costa, and nearly to tornus on dorsum, the under side of the wing in the ♂ is ochreous; in the ♀, this area though paler is not definitely outlined. At two-thirds are some scattered paler scales, sometimes (in ♀) forming an indistinct line across the wing. Cilia around the apex and last row of scales at the extreme apex pale ochreous. Cilia elsewhere concolorous with the wing. Hind wings gray, cilia concolorous.

Legs dull ochreous, mixed with fuscous; outer surface of fore and middle tibiæ and tarsi dark brown.

Expanse: 6.5 mm. (♂); 7-8 mm. (♀).

I have always found this species resting on leaves of saplings in dense woods with sparse undergrowth. The specimens in my collection were taken May 30 to July 6; a single specimen is dated August 5. I have thus far no clue to its life history.

BOOK REVIEWS.

THE HOUSE-FLY. ITS STRUCTURE, HABITS, DEVELOPMENT, RELATION TO DISEASE AND CONTROL. By C. Gordon Hewitt, D.Sc., F.R.S.C., Dominion Entomologist, 382 pp., 105 figs., Cambridge, at the University Press, 1914. Price 15 shillings net.

It is unusual to find a book dealing with as wide variety of subjects as this one, that does not show some inequality of treatment when carefully analyzed. The author generally reveals the fact that he is more at home in some branches of the subject than in others. Of Dr. Hewitt's book this cannot be said. Whether he discusses questions of minute anatomy or parasitology, bacteriology or the practical problems concerned with public health, he shows a thoroughness of grasp and a clearness of diction only possessed by the master.

The present work is an outgrowth of Dr. Hewitt's admirable monograph on the House-fly, which first appeared in three parts

in the Quarterly Journal of Microscopical Science in 1907, 1908 and 1909, and was republished in book form, together with several appendices in 1910 by the Manchester University Press. This edition was very limited and was soon exhausted, and as much new material had been brought to light by subsequent investigators in various countries, the author deemed it necessary to prepare a completely new work, bringing the subject matter thoroughly up to date.

The book is divided into six parts as follows: Part 1—The Structure and Habits of the House-fly. Part 2—The Breeding Habits, Life History and Structure of the Larva. Part 3—The Natural Enemies and Parasites of the House-fly. Part 4—Other Species of Flies frequenting Houses. Part 5—The Relation of House-flies to Disease. Part 6—Control Measures.

Of the 27 chapters, those dealing with structural matters are but slightly modified from the author's original accounts of these subjects. All the others contain a large quantity of information not found in the earlier work. This is especially true of Part 5, in which six chapters are included, an entire chapter being devoted to "the carriage of typhoid fever by flies," and another to "the relation of flies to summer diarrhœa of infants." In these and the other chapters of Part 5 the enormous literature dealing with experimental investigations in the dissemination of bacterial diseases and parasitic worms by flies is very carefully and concisely summarized and will prove of great interest and value to physicians and public health officers.

Following Part 6 is a bibliography of 36 pages and two indices, an author's and a subject index.

This book will undoubtedly remain the chief source of information on the house-fly for many years to come and will rank as a classic for all time.

Canadian Institute: General Index to Publications, 1852-1912. Compiled and edited by John Patterson, M.A. Honorary Secretary. University Press, Toronto, 1914. Price $5.00.

Students of all branches of Science, Literature and Art throughout Canada owe a debt of gratitude to Mr. and Mrs. Patterson for having undertaken and completed in such admirable fashion the arduous task of indexing the long series of publications of the Canadian Institute, from 1852 to 1912, including all the volumes published by the Institute before it received the title of "Royal."

The publications of the Canadian Institute have appeared in four principal series: The Canadian Journal (1852-1855) The Canadian Journal of Science, Literature and History (new series) (1856-1878); The Proceedings of the Canadian Institute (1879-1890) and the Transactions of the Canadian Institute (1890-1912); and one minor series, The Proceedings of the Canadian Institute (new series) (1892-1904). The last has not been included in the general index, but a list of the papers under authors is given in an appendix.

These volumes contain a vast amount of information on almost all subjects relating to Canada and a general index has been hitherto much needed. The present work satisfies this need most completely, being the contents of every paper dealt with in a thorough and detailed manner. The principal entries are in bold-faced type, and indented under these are the entries of subordinate topics. For instance, Ontario appears in bold-faced type and under it are more than three pages of entries of subjects relating to the Province. Similarly we find references to genera of animals and plants in bold-faced type, followed by species in ordinary type. Cross references are necessarily frequent, but have been avoided as far as possible.

This work will be of considerable value to entomologists in Canada. During the first years of the Institute's history, when there were few magazines dealing with special branches of science, the Canadian Journal formed one of the chief means by which papers on such subjects could be published; hence we find quite a number of articles on botany, entomology, ornithology, etc., in the earlier volumes. These are at least of historic value and contain many records of importance to the faunistic student. By means of this excellent index they are readily accessible, and there will now be no excuse for their being ignored or overlooked by modern workers, as has sometimes been done in the past.

FOREST INSECTS OF SWEDEN.

Sveriges Skogsinsekter. By Ivar Trägardh. VIII, 279 pp. 16 pls., 136 text figs. (Stockholm: Hugo Gebers.) 1914.

The comparative similarity of the forest conditions of Canada to those of Sweden gives this book a special interest to Canadian

entomologists. A number of forest insects are common to both countries. Our great regret is that, being written in the Swedish language, its contents will not be accessible to all who would wish to study it with care. The latter desire and the nature of its contents may, however, induce some to add another language to their vocabulary, for the excellence of its treatment would almost warrant such a venture.

After preliminary chapters on the characters and organization of insects, their development, and the general methods of control, the author takes the different orders, commencing with the Coleoptera, and describes those families and their members that are injurious to the forests, or useful as parasitic or predaceous enemies of forest insects. His treatment is somewhat along similar lines to that of Taschenberg in his "Praktische Insektenkunde." In the longest chapter, namely, the Coleoptera (Skalbagga), the following families are dealt with: Carabidæ, Staphylinidæ, Silphidæ, Histeridæ, Cantharidæ, Cleridæ, Elateridæ, Buprestidæ, Lymexylonidæ, Anobiidæ, Coccinellidæ, Cerambycidæ, Phytophaga, Curculionidæ, and Ipidæ, the last .of course, is treated the most extensively. The chief injurious species (or useful species as the case may be) in each family are considered individually and a description sufficient to enable the insect to be identified is given; the larvæ, habits and methods of control are also described in most cases. The excellent series of illustrations, largely original photographs, constitute a valuable feature of the volume. Where the insects are of serious importance, special attention is devoted to them, for example, the Nun Moth, *Lymantria monacha* L, whose introduction may we be spared, is given eleven pages; the Gipsy Moth hardly receives two pages!

A special chapter is devoted to gall-making insects and *Eriophyes*, and after a useful chapter on control measures, the book concludes with a table giving keys to the various insects according to the trees and parts of the trees they attack. We cannot say more than that we wish we had a similar work on our own forest insects. Perhaps the author will make his book more accessible to English-speaking readers by translating it some day, a task of which we know he is capable. C. G. H.

Mailed June 4th, 1915

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POPULAR AND ECONOMIC ENTOMOLOGY.

Poisoned Bait for Cutworms.

BY E. H. STRICKLAND,
Dominion Entomological Laboratory, Lethbridge, Alberta.

Experiments conducted at the Dominion Entomological Laboratory at Lethbridge, Alberta, during the past two years upon the control of *Porosagrotis orthogonia* and *Euxoa ochrogaster*, and again this Spring upon a species of *Chorizagrotis* have proved to us that shorts are far more valuable than bran as a bait for the purpose of poisoning.

In 1913, when experiments were first started, bran only was tried, and results were extremely disappointing, for it was seen that this material lost most of its attractiveness when dry. Under our semi-arid conditions it seems impossible to obtain a bran mixture that will remain sufficiently attractive after it has lost its moisture, some fifteen minutes after its application to the heated soil. In this connection it should be noted that we have no dew at night.

Numerous mixtures were given thorough, and repeated, trials under varying conditions, in which different quantities of salt, sugar, and various syrups were used as attractive agents. In all cases 1-10 acre plots were treated at, or after, sundown, and they were examined once or twice during the three or four days following the date of application. The bran was applied at the rate of 100 lbs, per acre, but even with this amount never more than 26% of the worms were killed.

The following are a few typical results from about 40 observations:—

On Fall Wheat

100 lbs. Bran, 2 lbs. Sugar, 2 lbs. Paris Green, 2½ gallons Water. —20% dead.

100 lbs. Bran, 6 lbs. Sugar, 2 lbs. Paris Green, 2½ gallons Water.—10% dead.

100 lbs. Bran, 6 lbs. Salt, 2 lbs. Paris Green, 2½ gallons Water. —10% dead.

On Spring Wheat

100 lbs. Bran, 1 gallon Molasses, 2 lbs. Paris Green, 2½ gallons Water.—26% dead.

100 lbs. Bran, 1 lb. Sugar, 2 lbs. Paris Green, 2½ gallons Water. —0% dead.

Similar results were obtained when the baits were employed on oats and alfalfa.

Obviously, we could not recommend any of these to the farmers, for even had they been fairly successful an application of 100 lbs. per acre is too heavy to be practical on our large prairie fields.

From notes made in 1913 we drew the following conclusions:—

1. Cutworms in dry localities feed largely in order to obtain moisture, and dry bran is not sufficiently attractive to be fed upon extensively when their normal moist food is available.

2. One species (*P. orthogonia*) for which we were poisoning feeds almost exclusively below ground, and a surface application of poisoned bait is therefore mainly wasted.

3. Molasses gave more hopeful results than any other attractive agent used.

In 1914 we tried replacing the bran with shorts, and harrowing the bait in when *P. orthogonia* was the species present, and specialized upon the molasses mixtures. Results were most gratifying, and we found that in each case the improvement was marked.

In all cases comparative tests were made simultaneously, and the following are some of the results on Spring Wheat:—

A. Surface application.

100 lbs. Bran, 1 gallon Molasses, 2 lbs. Paris Green, 4 gallons Water.—26% dead.

50 lbs. Bran and 50 lbs. Shorts, 1 gallon Molasses, 2 lbs. Paris Green, 4 gallons Water.—43% dead.

100 lbs. Shorts, 1 gallon Molasses, 2 lbs. Paris Green, 4 gallons Water.—53% dead.

25 lbs. Bran and 25 lbs. Shorts, ½ gallon Molasses, 1 lb. Paris Green, 2 gallons Water.—36% dead.

50 lbs. Shorts, ½ gallon Molasses, 1 lb. Paris Green, 2 gallons Water.—64% dead.

B. Harrowed in immediately after application.

25 lbs. Bran and 25 lbs. Shorts, ½ gallon Molasses, 1 lb. Paris Green, 4 gallons Water.—70% dead.

50 lbs. Shorts, ½ gallon Molasses, 1 lb. Paris Green, 4 gallons Water.—80% dead.

Most of the experiments were repeated from three to ten times under varying conditions, and the relative killing values were in every case similar to those given above. A few experiments in which sugar was used showed a marked inferiority.

For *Euxoa ochrogaster* the unharrowed plots gave slightly better results than the harrowed, and it was observed that this species feeds more frequently above the ground than does *P. orthogonia*.

By experimenting with varying amounts of Paris Green, and sweetening substances, we arrived at the following formula as giving the best results: Shorts, 50 pounds; Molasses, ½ gallon; Paris Green, 1 pound, and Water, 2½ gallons.

This mixture costs from $1 to $1.25 per acre for the ingredients alone, but since cutworms begin to damage a field in nearly every case in small well-defined areas, from which they spread subsequently over far larger areas, prompt treatment as soon as damage is seen reduces the cost per acre of the area saved to a small figure.

The superiority of Shorts over Bran has been again established in the control of Army Cutworms (*Chorizagrotis* spp.), which invaded part of the Province early this year. Results from field experiments upon these species are rather uncertain, since the migratory habits are so pronounced. In specially constructed field cages definite results were obtained, and comparisons show that the value of poisoned Shorts is certain, while the application of poisoned Bran is of very doubtful benefit when judged from the aspect of cost and results. The cages were set out in a clean field of spring wheat, so that the 50 worms placed in each, though confined to nine square feet, were in every other respect under identical conditions with those experienced in nature.

Unfortunately the weather turned cold when we started these experiments, and has remained so ever since, so that our percentage killings are not quite so high as they might have been had feeding been more general. Little of the wheat was eaten.

The following are a few of the results selected from 18 experiments and comprise those in which Kansas Grasshopper mixture, and a modification of it in which Shorts were used, were compared:

Poison was applied at the rate of 20 lbs. per acre. Examinations were made 48 hours after application. This was necessary, since dead worms are eaten readily by those still alive.

Applied to moist soil, and moistened by a shower.

20 lbs. Bran, 2 quarts Molasses, 1 lb. Paris Green, 3 Oranges, 3½ gallons Water.—26% dead.

20 lbs. Shorts, 2 quarts Molasses, 1 lb. Paris Green, 3 Oranges, 1 gallon Water.—56% dead.

Applied dry two days after mixing.

20 lbs. Bran, 2 quarts Molasses, 1 lb. Paris Green, 3 Oranges, 3½ gallons Water.—24% dead.

20 lbs. Shorts, 2 quarts Molasses, 1 lb. Paris Green, 3 Oranges, 1 gallon Water.—76% dead.

In the second case the weather was warmer, and more normal.

We found that the fruit in these and other mixtures had a slight beneficial effect, though the killing was as good with the following mixture: Shorts, 50 lbs.; Molasses, 2 gallons; Paris Green, 1 lb., applied at the rate of 20 pounds per acre. In this case no water was used, and we find that the benefit derived from using Paris Green in greater quantities than one pound to fifty pounds of Shorts (or Bran) does not warrant the extra cost.

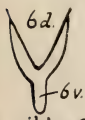
The only objection to Shorts is the difficulty of mixing, but if lots of not more than 50 pounds are mixed at a time, and the reduced quantity of water is added slowly during the mixing, the difficulty is minimized. Strangely enough, the greater the proportion of molasses to water the more readily the mixture is made.

From the above figures, which represent very few of the results obtained from our numerous experiments, all pointing to the same conclusions, it will be seen that we are having great difficulty in poisoning worms under our dry conditions, but by substituting bran with shorts the problem of control is brought nearer to solution, and since this modification has proved beneficial under a variety of conditions we believe that it will be found to be of value wherever poisoning is practised for the control of cutworms.

CHARACTERS SEPARATING THE SPECIES OF THE BEE GENUS *CŒLIOXYS* OCCURRING IN ONTARIO.

BY F. W. L. SLADEN,
Apiarist, Central Experimental Farm, Ottawa.

(The author has availed himself of a kind offer made by Prof. T. D. A. Cockerell to look over any tables of bees he had prepared. Prof. Cockerell's valuable notes are followed by his initials.)



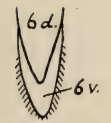


Fig. 24

MALES.

In all the following species the fore coxæ bear teeth:

1. *Second dorsal segment with a pair of transverse foveæ*, posterior to the transverse depression (interrupted or continuous) that crosses the segment. Tooth on either side of segment 5 well developed. . . . . 3.

No foveæ present, tooth on side of segment 5 rudimentary (apex of ventral segment 4 not emarginate) . . . . . 2.

[No foveæ, place where they would be very *densely* covered with minute punctures; tooth on side of segment 5 fairly large. Tegulæ bright apricot colour. (Indiana) . . *immaculata* Ckll.(I suppose this might extend to Canada.—T. D. A. C.)]

2. *Transverse depression on segment 2 uninterrupted in middle;* segment 1 well clothed with long hair, abdomen comparatively finely and closely punctured; postgenæ with large groove at lower end, the groove densely clothed with hair like rest of hind cheek. Apex of 4th ventral segment short, rounded; abdomen short and wide, *no carina on frons*, legs black . . . . . *ribis* Ckll.

(*C. ribis kincaidii* Ckll., from Olympia, Wash., also runs here.—T. D. A. C)

Transverse depression of segment 2 widely interrupted in middle; segment 1 clothed scantily, the hair very short and adpressed, abdomen coarsely and remotely punctured, *postgenæ without groove*, apex of 4th ventral segment bispinose, abdomen elongate; *frons with Y-shaped carina*, the forks flattened

out, enclosing the middle ocellus.....*alternata* Say
(=*texana* Cr.)

3. *Foveæ on segment 2 linear or very small*, legs more or less red; teeth on sides of segment 5 large, rudimentary teeth on sides of segment 4. Apical margin of 4th ventral segment lamellate and minutely emarginate.....4.

Foveæ comparatively large and wide (though often shallow), legs usually black, teeth on sides of segment 5 rather small, no trace of teeth on sides of segment 4.....7.

4. *Foveæ linear, each about ½ mm. long, with a narrow impunctate margin completely surrounding it*; (Good character!—T. D. A. C.); the hair on head and thorax rather longer, insect larger; length 8 to 10 mm.....*rufitarsus* Sm.

Foveæ rudimentary, not more than ¼ mm. long, sometimes minute, resembling a large puncture, hair on head and thorax rather shorter, insect smaller; length 7 to 9 mm. *octodentata* Say.

7. *Foveæ and the region anterior to it very closely punctured, the elevation posterior to it impunctate;* transverse grooves on segments 2 to 4 widely interrupted in middle, apical felt bands on segments 1 to 4 wide at sides, on segment 1 widely interrupted in middle, on segments 2 to 4 very narrow across middle; segments 2 to 4 more coarsely and remotely punctured; punctures on mesonotum far enough apart to give it a slight shine; hair on base of segment 1 adpressed.....*lucrosa* Cr.

The anterior region of each fovea not closely punctured, the elevation posterior to it remotely punctured; transverse grooves on segments 2 to 4 uninterruped in middle; apical felt bands on segments 1 to 4 less wide at sides, less narrow in middle, on segment 1 not interrupted in middle; segments 2 to 4 more finely and more closely punctured; mesonotum so closely punctured as to appear dull; hair on base of segment 1 upstanding.....*moesta* Cr.

FEMALES.

1. *Last ventral segment with a small notch on each side near the tip*.3.
Last ventral segment not notched.....2.

2. *Last ventral segment with apical portion narrowed to form a process about twice as long as wide and not more than one-third as wide as wider portion of segment;* clypeus without basal depression, transverse depression on segment 2 uninterrupted, segment 1 well clothed with long hair, abdomen short and wide, comparatively finely and closely punctured, no longitudinal carina on frons.....*ribis* Ckll.

[*C. ribis kincaidii* Ckll. (Olympia, Wash.), runs here. It is larger than typical *ribis*, and has tawny hair on head and thorax. It will doubtless be found in B. C.—T. D. A. C.]

Last ventral segment with sides convex, tapering to blunt point with a fringe of fuscous hair, clypeus with a depression on each side of its upper margin, transverse depression on segment 2 widely interrupted in middle; segment 1 scantily clothed, hair very short and adpressed; abdomen elongate; segments 2 to 4 coarsely and remotely punctured; frons with Y-shaped carina with the central ocellus between its forks.....*alternata* Say.

3. *Legs more or less red*.....4.

Legs not red; depressions on segments 2 and 3 always shallow, especially towards middle, where they are widely interrupted on segment 3; segments 1 to 5 more evenly and finely punctured.....6.

4. *Segment 6 1¼ times as long as wide, slightly rounded at apex;* depression on segments 2 and 3 narrow, deep and rugose, punctures on segments 1 to 5 large and close, an impunctate line immediately behind depressions on segments 2 and 3 and behind their vestiges on segments 4 and 5.....5.

Segment 6 1¾ times as long as wide, pointed at apex..*Cwl. 11.*

(*C. deplanata*, which occurs in Washington State, would come in about here, but it has the 6th dorsal segment obtuse at apex—on looking at other specimens it seems variable and may be fairly pointed. The 6th segment is quite broad in *deplanata* seen from above, its width is about three-quarters its length.—T. D. A. C.)

5. *Sixth dorsal segment strongly angulated at sides so that its apical half is narrowed;* larger insect; length up to 12 mm.....*rufitarsus* Sm.

Sixth dorsal segment not or only slightly angulated at sides, smaller insect; length up to 10 mm. . . . . *octodentata* Say.

6. *Transverse depression on segment 2 widely interrupted in middle;* apical felt bands on segments 2 to 4 wide at sides, very narrow across middle on segment 1, very wide and triangular at sides and widely interrupted in middle; punctures on segments 2 to 4 larger and less close; punctures on mesonotum far enough apart to give it a slight shine; hair on basal part of segment 1 adpressed; last dorsal segment about 1¼ times as long as wide; *tibial spurs more or less ferruginous* . . *lucrosa* Cr.

Transverse depression on segment 2 not or scarcely interrupted in middle; apical felt bands on segments 2 to 4 less wide at sides, less narrow in middle; on segment 1 much less wide at sides and uninterrupted in unrubbed specimens; punctures on segments 2 to 4 smaller and closer; mesonotum so closely punctured as to appear dull; hairs on basal part of segment 1 upstanding; last dorsal segment about twice as long as wide, *tibial spurs black* . . . . . *moesta* Cr.

A CONTRIBUTION TOWARDS THE TAXONOMY OF THE DELPHACIDÆ.

BY F. MUIR.

Hawaiian Sugar Planters' Experiment Station, Honolulu, T.H.

When working out some Malayan Delphacidæ the writer found it expedient to tabulate as many of the genera of the family as possible; unfortunately many of these genera are unknown to him except through the descriptions, which, in many instances, do not give characters necessary to locate them with accuracy. For this reason the present table has many defects, well recognized by the writer, but as it has been of great use to him he believes it will be of use to others, and for this reason alone he publishes it.

The Spur. As this organ is the characteristic feature of the family it is not surprising that its shape should be of taxonomic value; unfortunately many species have been described with only a mere reference to its existence. The writer is not aware of anyone making a primary use of it for dividing the family into divisions or subfamilies before Kirkaldy, who was followed by Crawford.

July, 1915

The spine-like, subulate spur is the most primitive and some of its possessors show the more generalized form of tegmina. The solid cultrate spur with both surfaces convex (Delphacini, Section A) appears to be the next stage, which is followed by the inner surface becoming concave (Section B) and eventually laminate (Section C). Section A is of interest as, with the exception of *Proterosydne** with one Australian and one American species, all the genera at present known are Hawaiian. With the exception of three species off grasses and sedges which are placed in Kelesia, all the native Hawaiian Delphacidæ belong to this section and are not attached to grasses. Swezey† has shown that *Nesodryas freycinetiæ* has but an apical tooth on the spur in first instar, those on the hind edge appearing at later instars. Section B contains six genera; of these, five, of which the habits are known, are attached to grasses. It is highly probable that further study will add several more to this section.

The antennæ. These organs come next to the spur for usefulness in taxonomic work; there appears to be but little specific variation and an absence of the sexual differences found in some of the other families of Fulgoroidea. The terete form is probably the more primitive, and the short basal joint more primitive than the longer basal joint.

The mesonotal carinæ. These are of great utility as they are always mentioned by describers and of their presence or absence there is little dispute.

The pronotal carinæ. Among some of the more difficult genera of section C of the Delphacini it is necessary not only to recognize the presence of these carinæ but also their shape and extension. Unless this is done it will be difficult to keep apart several genera containing different forms, and it will lead to the formation of one or more unwieldy genera of polymorphic character, whose species it will be more difficult to locate than are the present genera. This has been the case with Crawford's work on the north American forms and it will be still worse if the same methods are applied to the genera of the world.

It is generally possible to recognize two forms, those divergingly

*Crawford wrongly states this genus to be Hawaiian.
†Proc. Haw. Ent. Soc., II., 13.

curved posteriorly, or following, to a great extent, the contour of the hind margin of the eye, and which plainly do not reach the hind margin; and those which, although diverging posteriorly, are straight or convergingly curved, and meet the hind margin or approach it exceedingly closely.

Carination of head. In these we have the most unsatisfactory taxonomic characters, for in so many species they are obscured at the junction of vertex and face, and there is considerable variation in such characters as the furcation of the median frontal carinæ. In Homoptera such variation is common in all characters which undergo a great alteration at the last ecdysis*. In all nymphs of Delphacidæ with which the writer is acquainted there are two medio-longitudinal carinæ on the face which, in certain species amalgamate to a greater or lesser extent, the extent of amalgamation being variable. For this reason it has been necessary to place certain genera in two or three locations. With a wider knowledge of the species of certain genera, and their variations, than the writer possesses it is highly probable that more definite characterisation can be constructed.

Tibial spines of the hind legs have been used for taxonomic purposes, but they do not appear to be of great value for there is great specific variation; usually there is one at the base, one about middle and several at apex. It is possible that the proportional length of the first joint of hind tarsus and the absence or presence of one or two spines near the middle can be used more than they have been, also the proportional length of the front tibiæ.

For specific work it is absolutely necessary that the male genitalia be examined, and a use of it for generic distinction is possible in certain groups.

In the orismology the writer has used the term vertex as indicating that portion of the head, excluding the eyes, which can

*An extreme case of this nature is found in the Derbid genus *Zoraida* in which the face is only a narrow carina (composed of two carinæ more or less amalgamated) between the eyes; in the nymph the face is broad with two median carinæ well separated. In the adult the wide face still exists but is invaginated medio-longitudinally, the outer carinæ of the nymph forming the narrow face of the adult. This can be demonstrated by boiling a head of *Z. insulicola* (perhaps any other species) in caustic potash when the face will open. Several genera have been erected upon slightly widened faces (i.e. *Shirakia* and *Zoraidoides*) some of which are likely to be found to be imperfectly developed *Zoraida*.

be seen in a true dorsal view, irrespective of any carinæ which may appear to separate the vertex from frons. The term apex indicates the most anterior portion, considering the labrum as the most anterior of the dorsal portion of the head, irrespective of its deflexion.

With the increase in the number of known species and of our knowledge, it becomes necessary to divide and subdivide the groups of species included in the various sections of the Fulgorids; whether we consider the main divisions as families or subfamilies is a matter of personal opinion. Personally the writer thinks it is more natural and expedient to consider the Delphacids as a family, and the divisions as subfamilies. He holds the same opinion in regards to the Derbids, a group not so well defined as the Delphacids. It is more likely that future workers will follow Kirkaldy in this matter than those who wish to contain the whole of the Fulgorids (sens lat.) in one family.

The classification of this family, whatever arrangement we may use, shows parallel development and convergence. Arranged in the present order we see parallel development in carination of head and thorax, in lengthening and broadening of vertex and in the proportional length of joints of legs in each of the divisions. Another point clearly shown is the improbability of most or all of the characters used for taxonomic purposes being of vital importance to the individual or species. The spur is sometimes stated to be of use in jumping, but other Homoptera jump equally well without a spur; even if this argument be allowed can it be shown that one form of spur is superior to another?

The fact that a genus is included in the table does not imply that the writer considers it a good genus, there are several he considers it advisable to sink, but not without greater knowledge of the variation within the genera than he possesses at present.

The genera not located are:—*Calligypona*, placed by Ashanin after *Chlorionidea*, but not mentioned by Melichar in his Homoptera of middle Europe; *Epeurysa*, placed after *Eurysa* by Matsumura; *Dichoneura*, a South American genus which Crawford places, probably correctly, in the writer's Section B of the Delphacini; *Mestus*, the specimens marked *morio* (type species) that the author possesses do not agree with the original description; *Zuleika* placed by Distant near *Dicronotropis*.

The writer's knowledge of the genera is as follows:—

A. Examination of the type species:—
Aloha, Anectopia, Asiraca, Bambusibatus, Belocera, Chlorionidea, Conomelus, Copicerus, Criomorphus. Delphacinus, Delphax, Dictyophorodelphax, Eocurysa, Eurybregma, Eurysa, Gelastodelphax. Haplodelphax, Kormus, Laccocera, Lanaphora, Liburnia, Magemelus, Melanesia, Metropis, Nesodryas, Nesorestias, Nesosydne, Nesothoe, Pentagramma, Perigrinus, Perimececera, Perkinsiella, Phyllodinus, Proterosydne, Pseudaræopus, Punana, Saccharosydne. Smicrotodelphax, Sogatopsis, Stenocranus, Stobaera (?).

B. Examination of species other than the type:—
Chloriona, Dicranotropis, Eumetopina, Kelisa, Pissonotus, Purohita, Sardia, Tropidocephala, Ugyops.

C. From literature only:—
Achorotile, Amblycotis, Bakerella, Bergias, Bostæra, Calligypona, Canyra, Dichoneura, Embolophora, Eodelphax, Epeurysa, Epibidis, Eucanyra, Euidella, Haplalomelus, Idiosemus, Idiosystatus, Ilburnia, Jassidæus, Kalpa, Liburniella, Leimonodite, Livatis, Macrotomella, Malaxa, Meglamelanus, Micromasoria, Nesoplias, Nilaparvata, Ostama, Paranda, Platybrachys, Prokelisia, Pundaluoya, Rhinotettix, Sogata, Sparnia, Toya, Upachara Zuleika.

The writer hopes to improve upon the present table when he is better acquainted with more of the genera, and for this reason he would be pleased to receive for examination or exchange any species in list C and the type species of list B.

The writer takes this opportunity to thank Dr. L. Melichar for the gift of many species representing most of the European genera upon which the classification of the family is chiefly based.

In using the table it will be necessary to run the genus down in each section, as we are ignorant of the characters employed in so many instances.

The writer regrets that he has not been able to procure specimens of any of Mr. Distant's Indian genera as he feels sure some are at present wrongly placed in his table, but the nature of the spur is not stated in any instance.

(To be continued).

THE BEE GENUS *THRINCHOSTOMA* IN INDIA.

BY F. W. L. SLADEN,
Apiarist, Central Experimental Farm, Ottawa.

(This paper was submitted to Prof. Cockerell in March, 1915, who kindly added the valuable notes given in brackets.—F.W.L.S.)

Prof. T. D. A. Cockerell's description, on pages 35 and 36 of Vol. XLV of the Canadian Entomologist, as a new species, of a male and female of this curious genus that I recently sent him in a box of bees, has led me to examine the remainder of my specimens.

I find that the male and female described by Prof. Cockerell belong to two different species, for, besides a male that agrees fairly well with his description of *T. sladeni*, there is a male of a different species that evidently is the true mate of a female I possess that agrees fairly well with Prof. Cockerell's description of the female of *T. sladeni*.

My supposed male of *T. sladeni* agrees with Prof. Cockerell's description of the male in having the head and thorax clothed with white hairs, the margin of the clypeus cream-coloured, the legs red-brown, with the various creamy-white markings described, and in minor details, but it carries at the base of the 5th ventral segment of the abdomen, on either side of the middle, a cluster of three-hooked spines. The spines are arranged in a transverse line, the inner spine is the longest and the outer one the shortest. This remarkable and important structure is not mentioned in Prof. Cockerell's description.

The male of the other species, for which I propose the name *T. assamensis*, has also a transverse row of erect hooked spines at the base ofthe 5th ventral segment, but they number eight instead of six and are nearly equidistant and of equal length. This male, agrees with the female of mine that I refer to this species, and also with the female described by Prof. Cockerell under *T. sladeni*, in every important detail that is not sexual. In addition, it possesses in common with my female another remarkable character not mentioned by Prof. Cockerell. The second transverse cubital nervure does not reach to the radial nervure. [It does in my female, however.—T. D. A. C.]

The figure of *Halictus wroughtoni* Cameron shown on page 432 of Bingham's Hymenoptera of India, Vol. I (Fauna of British

India, 1897), is that of a male *Thrinchostoma*, allowing for engraver's errors. But, unfortunately, Bingham's accompanying description, which is of the female, is meager. In the colouring of the clypeus and legs and the structure of the base of the propodeum it agrees with *T. sladeni*, but in the colouring of the wing nervures with *T. assamensis*.

[*Assamensis* appears to be near to *T. macrognathum* (Friese) from Java, which (♂) has "Clypeus gelbbraun jederseits an Rande mit schwarzer Beule." Head and thorax yellow-haired. "Beine gelblich, gelbbraun behaart." Long 9-10 mm.; ♀ not known.

Friese redescribes your Khasia Hills insect as *sladeni*, using same ♀ and ♂ forms as I had. (Tijdschrift voor Entomologie, LVII (1914), p. 27.) Friese makes a subgenus (of *Halictus*) *Rostratilapis* for *macrognathum* and *sladeni*.—T. D. A. C.]

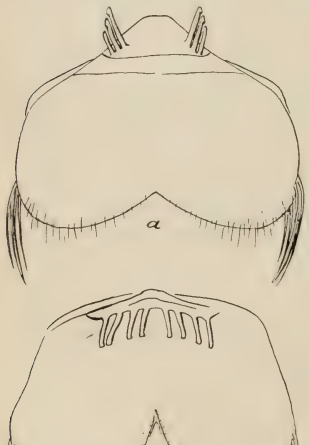


Fig. 25.—(See p. 215.)

Thrinchostoma assamensis, n. sp.

♂.—Length 13 mm. (head extended), expanse 21 mm. Head and thorax black, clothed with short pale fulvous hair; inner margins of the eyes concave; clypeus greatly extended, more so than in *T. sladeni*, clear yellow; supra-clypeal area piceous; malar space piceous, its extremity yellow; mandibles yellow, their tips piceous; labrum yellow; clypeus very shining, coarsely and remotely punctured; supra-clypeal space more closely and finely punctured; antennæ piceous; apex of scape paler; upper part of front finely and shallowly punctured, almost impunctate in the region of the ocelli; propodeum rounded

longitudinally rugose at the base; tegulæ testaceous. Wings hyaline, yellowish; nervures, stigma and hairs on wings pale testaceous; the first recurrent nervure joins the second submarginal cell before the end. Legs entirely testaceous-yellow; hind femora not much thickened, concave beneath; lobe on hind tibiæ wider than in *T. sladeni*. Abdomen has the first segment testaceous blackened in the centre and on either side at the base; second segment testaceous, with a transverse black band not narrowed in the middle; remaining segment black; as in *T. sladeni*, broad apical bands of shining white hair are noticeable in some lights on segments 3 to 5; abdomen shining, the basal segment impunctate; the dull, closely-punctured area on either side of the 2nd segment near the middle, present in *T. sladeni*, is absent; beneath, segments 1 to 4 pale; segments 5 and 6 black; segment 5 bilobate (in *T. sladeni* it is merely emarginate), bearing at its base a transverse row of erect hooked spines, eight in number, equal in length and nearly equidistant

♀.—Described by Cockerell, Can. Ent., Vol. XLV, p. 36, under the name of *T. sladeni*.

Habitat: Khasia Hills, Assam, India.

EXPLANATION OF FIGURES.

a. Thrinchostoma sladeni Ckll., ♂, 5th ventral segment.

b. Thrinchostoma assamensis, n. sp., ♂, 5th ventral segment.

THE TYPE OF *DELPHAX* FABR. AND *LIBURNIA* STAL.

BY E. BERGROTH, TURTOLA, FINLAND.

In his recently published "Contribution Toward a Monograph of the Delphacidæ of North and South America," Mr. D. L. Crawford discusses the use of the name *Delphax* by different authors, and correctly states that *Delphax crassicornis* Fabr. is the type of both *Delphax* Fabr. and *Arœopus* Spin., and that *Arœopus* consequently is a synonym of *Delphax*. He then proceeds to say: "In 1866 Stal (Hemipt. Africana, Vol. IV, p. 178) further complicated matters by restricting the name *Delphax* to *D. clavicornis*, which he erroneously supposed to be the type." In the cited place Stal does not at all speak of *Delphax*, but in the cited work and volume, p. 175, he expressly states: "*Delphax* Fabr., Stal = *Arœopus* Spin."

As *crassicornis* is the type of *Arœopus*, it is according to Stal clearly also the type of *Delphax*. *D. clavicornis* Fabr. is the type of *Asiraca* Latr., which Stal always called by its correct name; nowhere has he called this genus *Delphax*. Far from having "complicated matters," Stal was the first author who set down the correct type of *Delphax*. Crawford has apparently not seen Stal's Hem. Afr., and what he says seems to be based on wrong second-hand quotations in some obscure paper. He further states, probably relying on the wrong statements of Kirkaldy and Distant, that Stal used *Embolophora monoceros* Stal as the type of *Liburnia*. Had he known Stal's Hem. Afr., he would have seen that Stal maintained *Embolophora* as subgenerically or sectionally distinct from *Liburnia* proper. This fact is sufficient to preclude *monoceros* from the possibility of being considered the type of *Liburnia*. The type of the latter genus is *pellucida* Fabr., as pointed out by Van Duzee.

Crawford gives good descriptions, and in many cases detail-figures, of the American Delphacids known to him, citing only the the names (with bibliographical references) of the other species, but reproducing the descriptions of the genera which he had not seen. He has, however, overlooked Stal's important work, "Rio Janeiro Hemiptera, II: Homoptera." Of the new genera and species of Delphacidæ described by Stal in this work not even the names are mentioned. *Delphax cylindricornis* Fabr., redescribed from the type by Stal in his "Hemiptera Fabriciana" as *Canyra cylindricornis*, has also been omitted. From the facts that Crawford says this work was published in 1858, and that *Delphax seminigra* Stal (not "seminegra!") is described on p. 275 of it (whereas the work is from 1869, has only 130 pages, and contains nothing about that species) it is clear that the work is unknown to him. *Hygyops pictifrons* Stal from the Philippine Islands is cited as a synonym of *Delphax pictifrons* Stal from Mexico, a synonymy which had been impossible if the author had known the cited papers where these generically distinct species are described. In all Crawford enumerates seven of Stal's publications in his bibliographic list, but it seems dubious whether he has seen any of them.

Stal is the founder of modern hemipterology, and it is not advisable to begin the study of any group of the Homoptera Auchenorhyncha without knowing his works.

A KEY TO THE FAMILIES OF TRICHOPTEROUS LARVÆ.*

BY JOSEPH KRAFKA, JR., LAKE FOREST, ILL.

The larvæ of the caddis-flies are among the most common of aquatic forms; they are most interesting in their habits, and they are of undoubted economic importance; but their study is greatly retarded by the fact that there is available no means of determining them even approximately. The larvæ of the European fauna have been dealt with adequately by Ulmer, Siltala, Klapálek, Struck, Thienemann, and other European entomologists. While no thorough-going attempt has been made to trace the natural relationships in larval characters, the European genera and species can at least be recognized by keys of a more or less artificial character. Even this cannot be done for American genera, since the only species described are some eighteen by Vorhies in his excellent paper.† However, a key to the families is possible and shoufd prove serviceable, as none has so far appeared in English. Fol the key here offered, that of Ulmer‡ has been used as a basis, bur the whole ground has been covered in an independent study ot American material.

Reference to the figures should make the distinctions of the key clear, but perhaps the terms "thysanuriform" and "eruciform" as used in the order may be more fully explained. In the Trichoptera, those larvæ are designated as thysanuriform that have the long axis of the head in line with the long axis of the body, the abdomen dorso-ventrally compressed and the depressions between the segments deep. In the eruciform type, the long axis of the head is at a decided angle with the long axis of the body, the abdomen is cylindrical and the strictures between the segments shallow. The sub-eruciform type is intermediate between thysanuriform and eruciform.

*This key is prepared as a contribution to Dr. Betten's forthcoming monograph in which the structure of all the stages of Trichoptera is dealt with, and in which descriptions of all the American genera and of all eastern American species are included.

†Vorhies, Dr. Charles T., Studies on the Trichoptera of Wisconsin. Trans. Wis. Acad. Science Arts and Letters, Vol. XVI, Part 1, No. 6, 1909, pp. 647-738, pls. LII-LXI.

‡Ulmer, Dr. Georg, Trichoptera in Brauer's Die Süsswasserfauna Deutchlands, Heft 5 u. 6, 1909. Key to larvæ, pp. 213-217.

1a. Larvæ thysanuriform. (Fig. 1.) Abdomen of nine segments; prolegs not fused in median line to form an apparent tenth segment.* (Fig. 3.) No tubercles on first abdominal segment. No prosternal horn. No lateral line. Tracheal gills generally absent; rectal gills generally present, but not always everted.....2

1b. Larvæ eruciform or sub-eruciform. (Fig. 2.) Basal segments of prolegs fused in median line to form an apparent tenth abdominal segment. (Fig. 4.) Tubercles present on first abdominal segment. Prosternal horn often present. (Fig. 35.) Lateral line present, but sometimes very light. No rectal gills; tracheal gills generally present.....10

2a. Abdomen very much wider than the thorax. Small larvæ with portable cases of silk.....*Hydroptilidæ*.

2b. Abdomen not very much wider than thorax. Cases when present not of silk only.....3.

3a. Chitinous shield present on the dorsal surface of the ninth abdominal segment. (Fig. 7 and 8).....4.

3b. No chitinous shield on the dorsal surface of the ninth abdominal segment. (Fig. 3).....5.

4a. Prolegs well developed, free; claws of the prolegs long and slender, without teeth on convex surface, but sometimes with teeth on concave surface. Sometimes accessory claws present at side of main ones. (Fig. 7). Maxillary lobe long and slender. (Fig. 5.)...*Rhyacophilinæ* (Fam. *Rhyacophilidæ*).

4b. Prolegs short; basal segments wholly chitinized and fused to the ninth abdominal segment in a nearly vertical position. Claw very long with small teeth on convex side. (Fig. 8.) Maxillary lobes short, broad, with many sense rods. (Fig. 6) .....*Glossosomatinæ* (Fam. *Rhyacophilidæ*).

5a. Branched tracheal gills present. (Fig. 12.) All three thoracic segments chitinized dorsally. Numerous bristles on convex side of mandibles. (Fig. 13).....6.

5b. No tracheal gills. Only prothorax chitinized dorsally (except in *Econominæ*, where all three segments are chitinized). Only two bristles on convex side of mandibles.....7.

*In the Hydroptilidæ there is an indefinite suture crossing the ninth segment dorsally, giving somewhat the appearance of a tenth, but this family can easily be set off by the general shape of the body (see 2a).

LARVÆ OF TRICHOPTERA.

(See p. 224).

6a. Dorsal surface of head flattened, forming a broad disk, inclosed by a heavy horse-shoe shaped ridge or carina, making a false clypeus. This carina crosses the true clypeus near its apex, setting off a small triangle. (Fig. 10.) Mandibles toothed on whole inner margin; teeth broad and blunt; interspaces broad and deep. (Fig. 13)
Macronematinæ (Fam. *Hydropsychidæ*)

6b. Dorsal surface of the head flattened, but disk not so sharply defined and practically limited to the true clypeus. (Fig. 11.) No carina. Mandibles with sharp teeth at apical end. *Hydropsychinæ* (Fam. *Hydropsychidæ*).

7a. Labrum not wholly chitinized; its anterior angles and membrane connecting it to the clypeus, forming a flexible lip, bearing numerous bristles. Usually the anterior margin of the clypeus is asymmetrically curved (Fig. 9) *Philopotamidæ*.

7b. Labrum wholly chitinized; its anterior angles rounded. Anterior margin of the clypeus never asymetrically curved 8

8a. All three thoracic segments chitinized dorsally *Econominæ* (Fam. *Polycentropidæ*).

8b. Only prothorax chitinized dorsally 9.

9a. Claws of legs long, slender, with but one basal spur. (Fig. 15.) Labial lobes short, not so long as the maxillary palps (except in *Phylocentropus*). Penultimate segment of maxillary palpus very long. (Figs. 16, 17) *Polycentropidæ*.

9b. Claws of legs short; claw on first leg bears a basal spur and a bristle beside it. (Fig. 14.) Two basal spurs on claws of second and third legs. Labial lobe long, slender, pointed, generally longer than the maxillary palps. Maxillary palps short; segments of equal length. (Fig. 18)
Psychomyidæ.

10a. Labrum with a very distinct row of twenty or more heavy bristles traversing its dorsal surface at about one-third the distance from its front margin. (Fig. 19)
Calamoceratidæ.

10b. Labrum without armature as above in 10a. Generally only three pairs of black bristles on its dorsal surfaces and three pairs of yellow spines on its front margin. (Fig. 20) 11.

11a. Labrum much longer than broad. (Fig. 21.) Pronotum and mesonotum chitinized. Metanotum with four plates; two broad medium ones, lying one behind the other (the posterior one being hard to distinguish) and two lateral ones, small and triangular. (Fig. 22).....*Odontoceridæ*.

11b. Labrum much broader than long. (Fig. 20.) Thoracic armature various, but not as above.....12.

12a. *Gula subquadrate, widely separating the pleuræ. (Figs. 23, 24.) Prothorax and mesothorax chitinized dorsally. Metathorax membranous. No prosternal horn.....13.

12b. *Gula triangular or elongated. Pleuræ contiguous or nearly so at the apex of the gula. (Figs. 25, 26.) Thoracic armature not as in 12a. Prosternal horn generally present. (Fig. 35).....15.

13a. Long spur-bearing processes on distal ends of first and second tibiæ. (Fig. 27.) Hind tibiæ divided. (Fig. 28.) Hind claw either long and bristle-like or very short and bearing many bristles. (Fig. 29.) Labial lobe with numerous bristles near the middle of the ventral side ..... *Molanninæ* (Fam. *Molannidæ*.)

13b. No spur-bearing processes on first and second tibiæ, but sometimes a swelling on the first tibiæ. (Fig. 32.) Hind tibiæ not divided except in *Mystacides*. Claws normal. Few bristles on labial lobe.....14.

14a. Femora not divided into a short apical and a long distal piece. Mandibles with inner bristles, and a clump of accessory bristles near distal end of convex side. (Fig. 30). Chitin points over lateral line on abdominal segments III to VIII. ..... *Berœinæ* (Fam. *Molannidæ*).

14b. Femora of middle and hind legs divided into a small basal and a long apical piece. (Fig. 31.) Right mandible without inner bristles. No accessory bristles on back of mandibles ..... *Leptoceridæ*.

*In two subfamilies the characters will not agree with all those listed in either 12a or 12b. Forms agreeing with 12b in all except the form and position of the gula (*Brachycentrinæ*) or in all except thoracic armature (*Sericostomatinæ*) should remain in 12b.

15a. Postsegmental gills on lateral line always covered with black hairs. (Fig. 33). Prothorax only chitinized. One pair of small bristle-bearing plates on mesothorax and on metathorax ..... *Phryganeidæ*.

15b. Gills never with black hairs. Thoracic armature not as in 15a.....16.

16a. Prothorax and mesothorax chitinized dorsally. Metathorax membranous, bearing three pairs of small shields; median anterior pair very small; second pair small, slightly laterad and posterior to first; third pair largest, generally crescent-shaped, lying laterad to second; all well supplied with bristles. (Fig. 34)..... *Limnophilidæ*.

16b. Thoracic armature not as in 16a.....17.

17a. Pronotum chitinized. Mesothorax bearing two or three pairs of heavily chitinized plates, metathorax with two or four pairs of smaller plates.....18.

17b. Pronotum chitinized. Mesonotum and metanotum membranous, or at most only weakly chitinized.....19.

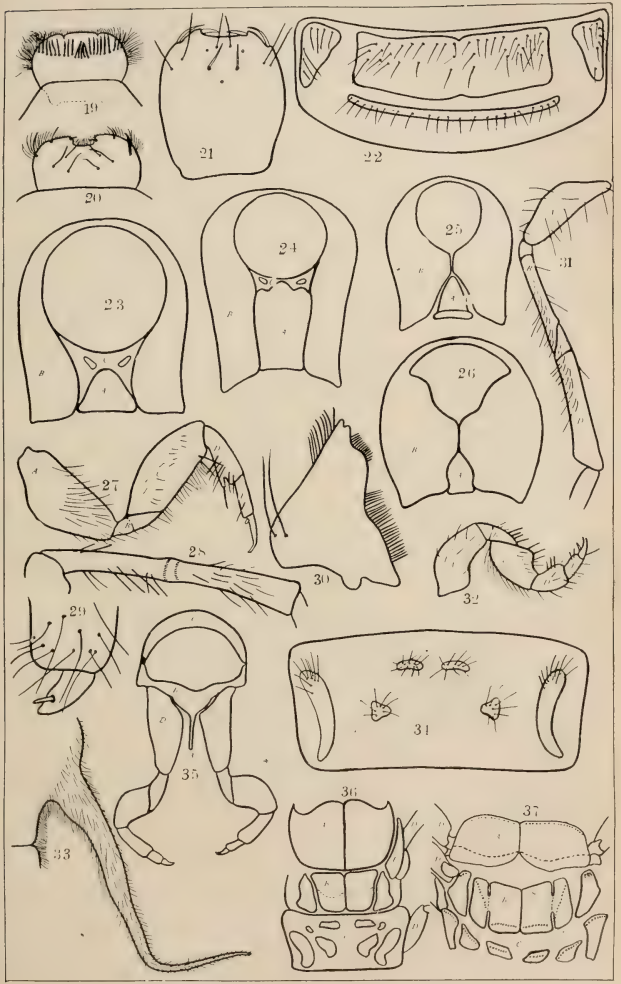
18a. Anterior angles of pronotum produced into pointed processes. Head retractile. Two or three pairs of plates on mesothorax; four pairs on metathorax. (Fig. 36).—Tubercles present on first abdominal segment. Gula triangular; pleuræ nearly contiguous behind its apex. (Fig. 25) .....*Goerinæ* (Fam. *Sericostomatidæ*).

18b. Anterior angles of pronotum rounded. Head not retractile. Four broad plates on mesothorax, but only two pairs of smaller ones on metathorax. (Fig. 37.) No lateral tubercles on first abdominal segment. Gula subquadrate; pleuræ separated widely by the gula. ..... *Brachycentrinæ* (Fam. *Sericostomatidæ*).

19a. Only lateral tubercles on first abdominal segment well developed. Gills thread-like, single. Middle and hind tibiæ with one distal spur each. Prosternal horn present .....*Lepidostomatinæ* (Fam. *Sericostomatidæ*)

19b. All three tubercles on first abdominal segment well developed. Gills thread-like, clustered; only on the anterior margins of the segments. Middle and hind tibiæ without distal spur. No prosternal horn. *Sericostomatinæ* (Fam. *Sericostomatidæ*)

Lake Forest College.



LARVÆ OF TRICHOPTERA.

(See p. 225).

Explanation of Plates VI and VII.

PLATE VI.

Fig. 1. *Macronema zebratum* Hag.; a, branched tracheal gills; b, prolegs; c, rectal gills.

Fig. 2. *Phryganea* sp.; a, tubercles; b, tracheal gills; c, lateral line; d, prolegs.

Fig. 3. *Macronema zebratum* Hag.; ventral aspect of prolegs; a, 8th abdominal segment; b, 9th abdominal segment; c, basal segment of prolegs; d, claw of proleg.

Fig. 4. *Platycentropus hostis* Hag.; dorsal aspect of prolegs; b, 9th abdominal segment; c, basal segments of prolegs forming a 10th abdominal segment; d, claws of prolegs; e, supporting plate of claw.

Fig. 5. *Rhyacophila fuscula* Walk.; labium and maxilla; a, labial lobe; b, labial palpus; c, maxillary lobe; d. maxillary palpus.

Fig. 6. *Mystrophora americana* Banks; labium and maxilla; a, labial lobe; b, labial palpus; c, maxillary lobe; d, maxillary palpus.

Fig. 7. *Rhyacophila fuscula* Walk.; lateral view of prolegs; a, 8th abdominal segment; b, 9th abdominal segment; c, claw of proleg; d, accessory claw; e, basal segment of proleg; f, dorsal plate on 9th abdominal segment.

Fig. 8. *Mystrophora americana* Banks; a, 8th abdominal segment; b, 9th abdominal segment; c, claw of proleg; d, basal segment of proleg; e, dorsal plate on 9th abdominal segment.

Fig. 9. *Chimarrha* sp.; dorsal view of clypeus and labrum; a, clypeus; b, labrum; c, connecting membrane; d, anterior angles of labrum.

Fig. 10. *Macronema zebratum* Hag.; dorsal view of head; a, true clypeus; b, false clypeus; c, carina; d, labrum; e, connecting membrane; f, mandibles.

Fig. 11. *Hydropsyche* sp. dorsal view of head; a, true clypeus; b, labrum.

Fig. 12. *Macronema zebratum* Hag.; branched tracheal gill.

Fig. 13. *Macronema zebratum* Hag.; ventral aspect of left mandible.

Fig. 14. *Psychomyia pusilla* Fabr; claw of 1st leg (after Ulmer).

Fig. 15. *Phylocentropus* sp.; claw of 1st leg.

Fig. 16. *Phylocentropus* sp.; labium and maxillæ; a, labial lobe; b, max. lobe; c, max. palpus.

Fig. 17. *Plectrocnemia conspersa* Curt.; labium and maxilla (after Ulmer); a, labial lobe; b, max. lobe; c, max. palpus.

Fig. 18. *Psychomyia pusilla* Fabr.; labium and maxilla (after Ulmer); a, labial lobe; b, max. lobe; c, max. palpus.

PLATE VII.

Fig. 19. *Ganonema americanum* Walk.; dorsal view of labrum.

Fig. 20. *Chilostigma* sp.; dorsal view of labrum.

Fig. 21. *Psilotreta frontalis* Banks; dorsal view of labrum.

Fig. 22. *Psilotreta frontalis* Banks; dorsal view of metathorax showing chitinous plates.

Fig. 23. *Leptocella uwarowii* Kol.; ventral view of head; a, gula; b, pleura; c, membrane.

Fig. 24. *Mystacides sepulchralis* Walk.; ventral view of head; a, gula; b, pleura; c, membrane.

Fig. 25. *Goera pilosa* Fabr.; ventral view of head; a, gula; b, pleura; c, membrane.

Fig. 26. *Arctoecia medialis* Banks; ventral view of head; a, gula; b, pleura.

Fig. 27. *Molanna cinerea* Hag.; first leg; a, coxa; b. trochanter; c, femur; d. tibia; e, tarsus.

Fig. 28. *Molanna cinerea* Hag.; femur of 3rd leg.

Fig. 29. *Molanna cinerea* Hag.; claw of 3rd leg.

Fig. 30. *Beræodes minuta* L.; mandible (after Ulmer).

Fig. 31. *Leptocella uwarowii* Kol.; third leg; a, coxa; b, trochanter; c, apical piece of femur; d, distal piece of femur.

Fig. 32. *Leptocella uwarowii* Kol.; first leg; a, coxa; b, trochanter; c, femur; d, tibia; e, tarsus.

Fig. 33. *Phryganea* sp.; tracheal gill.

Fig. 34. *Platycentropus hostis* Hag.; dorsal view of metathorax.

Fig. 35. *Arctœcia medialis* Banks; anterior view of prothorax; a, prosternal horn; b, prosternum; c, pronotum; d, 1st leg.

Fig. 36. *Gœra pilosa* Fabr.; thoracic armature; a, prothorax; b, mesothorax; c, metathorax; d, base of legs; e, supporting plates.

Fig. 37. *Brachycentrus nigrosoma* Banks; thoracic armature; a prothorax; b, mesothorax; c, metathorax; d, base of legs.

NEW NORTH AMERICAN GALL MIDGES.

BY E. P. FELT, ALBANY, N. Y.

The following descriptions relate to undescribed species which have been received from various localities during several months past.

Lestremia floridana, n. sp.

The midge characterized below was collected by Mr. C. W. Johnson and labelled Jacksonville, Fla. It is easily separable from both *L. elongata* Felt and *L. barberi* Felt by the relatively much longer antennal segments. The somewhat similar *L. sambuci* Felt and *L. kansensis* Felt are easily distinguished from this species by the much greater production and more slender character of the terminal antennal segment.

Female.—Length 1.2 mm. Antennæ extending to the base of the abdomen, sparsely haired, reddish brown; 11 segments, the fifth with a stem about ¼ the length of the cylindric basal enlargement, which latter has a length 2½ times its diameter; terminal segment moderately stout, only slightly produced, the basal portion with a length three times its diameter and apically with a short, stout, fusiform appendage. Palpi: first segment narrowly oval, with a length over twice its diameter, the second ½ longer than the first, more slender, the third ½ longer than the second, more slender, the fourth nearly twice as long as the third, slender, irregular. Mesonotum yellowish brown. Scutellum yellowish, postscutellum reddish yellow. Abdomen reddish brown. Halteres, coxæ and femora basally, fuscous yellowish, distal portion of femora, tibiæ and tarsi reddish brown. Claws moderately stout, simple, the pulvilli about half the length of the claws. Ovipositor triarticulate, the terminal lobe narrowly ovoid and with scattering, large setæ in addition to numerous smaller ones. Type Cecid. 1514.

Microcerata aldrichii, n. sp.

The midges described below were collected by Prof. J. M. Aldrich by sweeping winter wheat at Lafayette, Ind., May 6, 1914. The species approaches closely *M. spinosa* Felt, from which it may be easily separated by the darker colour and the fused eighth and ninth antennal segments of the male, the latter having a length

about twice its diameter, while in *M. spinosa* these two segments are free, the last having a length only about three-fourths greater than its diameter. There are doubtless other differences in the similar appearing midges.

Male.—Length 1.5 mm. Antennæ moderately short, tapering, the basal segment dark brown, the others light brown; 9 sessile segments, the second greatly enlarged, the ninth plainly fused with the eighth, and with a length about twice its diameter. Palpi: first segment subquadrate, with a length over twice its diameter, the second a little longer and more slender than the first, the third one-half longer than the second, more slender, the fourth twice as long as the third, slightly expanded distally. Body a nearly uniform brownish black, the submedian lines of the mesonotum sparsely haired. Wings moderately large, costa, subcosta and the third vein yellowish brown, whitish basally. Halteres yellowish transparent. Coxæ dark brown. Legs mostly fuscous yellowish, the pulvilli as long as the moderately stout, slightly curved, finely pectinate claws.

Genitalia: basal clasp segment moderately stout, long; terminal clasp segment short, swollen basally, somewhat recurved and thickly setose apically; dorsal plate moderately long, triangularly emarginate, the lobes narrowly rounded apically; ventral plate long, apically roundly and obliquely truncate and thickly setose.

Female.—Length 1 mm. Antennæ yellowish brown, the second segment only moderately enlarged, the fourth with a length about three-fourths its diameter and with thick groups of short, stout spines subapically; terminal segment produced, with a length nearly twice its diameter, somewhat swollen basally and broadly rounded apically. Body a nearly uniform brownish black. Ovipositor short, the lobes yellowish, biarticulate, the distal segment roundly oval and thickly setose, minor lobes thickly setose, triangular, narrowly rounded apically. Type Cecid 1585.

Porricondyla wellsi, n. sp.

The midge described below was taken by Mr. D. B. Young on a window at Wells, N. Y., July 5, 1914. It is easily distinguished from allied forms by the greatly produced stems of the flagellate

antennal segments and the short, greatly swollen terminal clasp segment.

Male.—Length 2 mm. Antennæ a little longer than the body, sparsely haired; 16 segments, the fifth with a stem twice the length of the basal enlargement, which latter has a length one-half greater than its diameter; terminal segment reduced, with a length nearly three times its diameter and tapering almost uniformly to an acute apex. Palpi reddish, first segment with a length four times its diameter, second a little shorter, stouter, the third longer than the second, more slender and the fourth one-half longer than the third. Mesonotum shining dark brown. Scutellum and postscutellum yellowish. Abdomen yellowish white, with narrow, double, transverse, brownish sclerites on each abdominal segment, the distal segments tinged with reddish. Genitalia fuscous yellowish. Halteres and coxæ pale yellowish. Legs mostly a variable straw; claws rather slender, strongly curved, unidentate, the pulvilli as long as the claws. Genitalia; basal clasp segment short, stout; terminal clasp segment short, greatly swollen near the middle and with a length hardly one-half greater than the diameter; dorsal plate rather long, deeply and roundly emarginate, the lobes broadly rounded; ventral plate moderately long, broad, deeply and triangularly emarginate, the lobes tapering to a roundly truncate apex. Harpes short, stout, irregular, heavily chitinized. Type Cecid. 1564.

Asteromyia sylvestris, n. sp.

The yellowish or brownish blister leaf galls of this species were very abundant October 22, 1914, on *Aster cordifolius* at Mount Kisco, N. Y. A number of adults were reared together with several parasites, the latter undetermined.

Gall.—Diameter three to four mm., circular, a variable yellowish or brownish blister leaf gall on *Aster cordifolius*. Some are yellowish with brown centres and others mostly dark brown. There may be three to twenty on a leaf and the larvæ evidently hibernate in the gall, though adults appeared under insectary conditions in mid-winter.

Male.—Length 1.6 mm. Antennæ extending to the base of the abdomen, sparsely haired, reddish brown; 16 segments, the fifth with a length one-fourth greater than its diameter; terminal

segment somewhat produced, with a length nearly one-half greater than its diameter and sometimes partly fused with the preceding. Palpi; first segment narrowly oval, the second one-half longer, tapering to a subacute apex. Mesonotum shining reddish brown, the submedian lines sparsely haired. Scutellum and postscutellum shining yellowish brown. Abdomen mostly dark brown basally, the segments sparsely margined sublaterally and posteriorly with a broken line of white scales, the fifth to the seventh segments sparsely clothed with fuscous scales, the latter hardly obscuring the reddish orange colour of the abdomen; discal spot white, elongate and near the middle of the wing. Halteres fuscous yellowish basally, fuscous apically. Coxæ fuscous yellowish, femora and tibiæ fuscous yellowish basally, fuscous apically; tarsi a nearly uniform dark brown; claws long, rather slender, strongly curved, unidentate, the pulvilli nearly as long as the claws. Genitalia; dorsal plate deeply and triangularly emarginate, the broad lobes broadly and rather irregularly rounded; ventral plate long, broad, broadly rounded.

Female.—Length 2 mm. Antennæ fuscous basally, yellowish or reddish apically, sparsely haired; 16 segments, the fifth with a length about equal to its diameter. Palpi; the first segment with a length nearly twice its diameter, the second a little longer than the first, abruptly tapering distally. Mesonotum dark reddish brown. Scutellum and postscutellum dark brown. Abdomen a nearly uniform brownish black, the ovipositor fuscous yellowish, about one-third the length of the abdomen, the terminal lobes being broadly ovate and thickly setose. Halteres yellowish transparent basally, brownish black apically. Coxæ and legs a nearly uniform brownish black, the posterior tibiæ narrowly and indistinctly annulate distally with white. Type Cecid. a2585.

Kalodiplosis, n. g.

The unidentate, heavily toothed claws, the rudimentary pulvilli, the third vein joining the margin at or slightly before the apex of the wing, the triarticulate palpi, the heavy, rather thick and moderately short circumfili, and the long dorsal and ventral plates, the latter deeply emarginate and with relatively narrow lobes, serves to distinguish this genus from *Dicrodiplosis* Rubs. and the series related thereto. Type *Dicrodiplosis multifila* Felt.

Kalodiplosis multifila Felt

1907 Felt, E. P. New Species of Cecidomyiidæ II, p. 19-20 (Dicrodiplosis).

1908 Felt, E. P. N. Y. St. Mus. Bul. 124, p. 300, 394 (Dicrodiplosis).

The male representing this species is in the U. S. National Museum and was collected by August Busck at Porto Rico.

Male.—Length 1.5 mm. Antennæ as long as the body, thickly haired, dark brown; 14 segments, the fifth having the basal part of the stem with a length about one-half its diameter, the distal part with a length three-fourths its diameter; basal enlargement subglobular, the distal enlargement vasiform and with two circumfili, each with about twelve moderately heavy, stout loops; terminal segment, basal portion of the stem with a length twice its diameter, the distal enlargement subcylindric, with a length nearly twice its diameter, at the distal fourth tapering to an acute apex. Palpi; first segment short, stout, subglobose, the second with a length thrice its diameter, the third longer and more slender than the second. Mesonotum dark brown, the submedian lines indistinct. Scutellum dark reddish brown, postscutellum fuscous. Abdomen dark brown, the segments sparsely margined posteriorly with coarse setæ. Costa light straw, the third vein joining the margin just before the apex, the fifth forked; halteres fuscous yellowish. Coxæ and base of femora pale yellowish, the distal portion of femora, tibiæ and tarsi a variable brown; claws long, stout, strongly curved, unidentate, the pulvilli about half the length of the claws. Genitalia; basal clasp segment long, stout; terminal clasp segment short, swollen basally; dorsal plate long, broad, broadly and roundly emarginate, the lobes irregularly rounded; ventral plate long, broad, dilated apically, broadly and triangularly emarginate, the lobes rather slender and narrowly rounded. Type Cecid. 1024.

Kalodiplosis floridana, n. sp.

The midges described below were received under date of September 21, 1914, from Dr. Frederick Knab and recorded as having been collected August 22, 1914, on sea grape (*Coccoloba*) at Miami, Fla., by W. W. Yothers. This species is easily dis-

tinguished from *K. multifila* Felt, by the longer stems of the flagellate antennal segments as well as by differences in colour.

Male.—Length 1 mm. Antennæ probably one-half longer than the body, thickly haired, yellowish brown; 14 segments, the fifth having the stems nearly equal, each with a length one-half greater than the diameter; terminal segment missing. Palpi; first segment irregularly ovate, the second with a length over twice its width, the third one-half longer than the second, more slender. Mesonotum dark reddish brown. Scutellum and postscutellum yellowish. Abdomen mostly dark brown, yellowish brown apically. Halteres yellowish basally, slightly fuscous apically. Coxæ and femora fuscous straw, the tarsi somewhat darker; claws stout, unidentate, the pulvilli about half the length of the claws. Genitalia; basal clasp segment long, stout; terminal clasp segment short, rather stout, swollen near the basal third; dorsal plate long, broad, deeply and triangularly emarginate, the lobes rather long, broad and narrowly rounded; ventral plate long, deeply and triangularly emarginate, the slender, slightly diverging lobes narrowly rounded and sparsely setose apically; style long, stout, strongly curved.

Female.—Length 1.25 mm. Antennæ probably nearly as long as the body, sparsely haired, yellowish brown; 14 segments, the fifth with a stem one-fourth the length of the cylindric basal enlargement, which latter has a length about twice its diameter; terminal segment slightly prolonged and obtusely rounded apically. Palpi; first segment irregularly ovate, the second rather slender, with a length nearly three times its diameter, the third a little longer and more slender than the second. Mesonotum dark brown. Scutellum and postscutellum yellowish. Abdomen reddish brown, yellowish basally and with an oval subbasal spot dorsally. Halteres mostly a light fuscous yellowish. Coxæ and femora mostly fuscous yellowish, the apical portion of femora, tibiæ and tarsi dark brown. Ovipositor short, the terminal lobes narrowly oval and sparsely setose. Other characters practically as in the male. Type Cecid. 1563.

Hormomyia fenestra, n. sp.

This species is closely related to *H. shawi* Felt, though easily distinguished by marked differences in colour characters and in

the structure of the basal clasp segment. Both sexes were taken by Mr. C. P. Alexander, August 22, 1910, at Woodworth's Lake, Fulton County, N. Y.

Male.—Length 5 mm. Antennæ probably as long as the body, sparsely haired, dark yellowish brown; probably 15 segments, the fifth having the two portions of the stem nearly equal, each with a length one-half greater than the diameter. Palpi; the first segment irregular, with a length about twice its diameter and apically with an irregular, quadrate, pseudo-segment; the second segment extremely slender, with a length fully ten times its diameter and at the basal third a pseudo-articulation. Mesonotum reddish brown, the submedian lines and posterior median area, scutellum and postscutellum mostly brownish yellow. Abdomen dark brown. Genitalia fuscous yellowish, the basal clasp segment subrectangular, with a length about three times its diameter and a conspicuous, broadly rounded internal lobe at the basal third; terminal clasp segment stout, curved, diameter nearly uniform, fuscous apically; dorsal plate broad, broadly and irregularly emarginate, the lobes broad and tapering irregularly to a narrowly rounded, setose apex; ventral plate long, spatulate, sparsely setose, broadly and roundly emarginate distally.

Female.—Length 5 mm. Antennæ missing. Palpi; the first segment subglobose, the second rectangular, with a length one-half greater than its diameter, the third greatly produced, with a length fully ten times its diameter. Mesonotum a variable reddish brown, the submedian lines brownish yellow. Scutellum and postscutellum mostly fuscous yellowish. Abdomen sparsely haired, dark reddish brown. Halteres yellowish transparent. Coxæ yellowish brown, legs a variable straw colour, the articulations slightly darker. Ovipositor short, the terminal lobes broadly oval and thickly clothed with short, stout setæ, minor lobes triangular, with a few coarse setæ on the rounded apex. Type Cecid. 1596.

The female, Cecid. 1595 is referred with little question to the same species, a procedure justified by similar abdominal structures and the capture of the two on the same date and under presumably identical conditions. The specific name is given on account of the peculiar, light coloured, window-like spots in the body walls of the abdomen.

A NEW GENUS AND SPECIES OF TRICHOGRAMMATIDÆ FROM THE PHILIPPINES.

BY A. A. GIRAULT,
Bureau of Entomology, U. S., Department of Agriculture.

The following genus belongs to the Chætostrichini:

Pseudobrachysticha, new genus.

Female.—In my table of genera runs to *Brachysticha* Mayr, but differs from that genus in that there is only one-ring joint and the fore wings are naked, the marginal ciliation at the apex but moderately long and the club is 2-jointed, the antennæ 6-jointed. Moreover, in the male the club is solid. Because the single funicle joint is connected rather closely with the club, sometimes making the latter appear 3-jointed, this genus may be confused with *Pterygogramma* Perkins, but the male is different from the female, the discal ciliation of the fore wing is absent, excepting a single line of it along the cephalic margin from venation to apex, the funicle is really present and the ovipositor is inserted in the middle of the abdomen. Marginal vein as long as the submarginal, the stigmal with a short neck and a rounded knob. Mandibles tridentate. Male the same, except the shape of the abdomen and the 5-jointed antennæ. A short, distinct postmarginal vein.

1. **Pseudobrachysticha semiaurea,** new species.

Female.—Length, 0.60 mm.

Bright golden yellow, the abdomen black (the incisions of the segments sometimes showing through as yellow cross-stripes), the venation dusky black, the fore wing smoky from base to slightly beyond the apex of the venation, but subhyaline at base to the break of the submarginal vein and along under the marginal vein, the infuscation accented across from base of the marginal vein and less so across from the apex of the stigmal (thus more or less bifasciate). Caudal wings slightly dusky to some little distance beyond the venation. Two to four isolated cilia on the fore wing in a line longitudinally between apex of stigmal vein and apex of the wing. Marginal cilia at apex of the fore wing about between a fourth and a third of the greatest wing width, distinctly shorter the caudal marginal cilia of the caudal wing. The latter rather broad, but distinctly narrower than the length of its marginal

cilia, naked discally, excepting for a pair of isolated cilia in a line longitudinally, central and somewhat proximad of the middle between the apex of the venation and the apex of the blade. Antennal club dusky. Cephalic face of the pronotum black. Hind femora sometimes dusky. Scape and legs nearly white.

The male is similarly coloured.

Described from a large number of specimens of both sexes reared from the eggs of *Hilda breviceps* Stal, Los Banos, Philippine Islands, February, 1915, C. F. Baker.

Types.—Catalogue *No. 19300*, U. S. N. M., four males, four females on a slide. A large number of paratypes on another slide.

A NEW SPECIES OF *PSEUDOMPHALE* FROM CHILE.

BY A. A. GIRAULT,
Bureau of Entomology, U. S. Dept. Agriculture.

The genus *Pseudomphale* Schrottky is the same as *Horismenus* in the North American sense. It may be *Horismenus* in the European sense, yet doubtfully. There are three ring-joints. The single Australian species of *Horismenus* represents a new genus which may be named *Horismenopsis*, new genus. The genotype is *Horismenus antiopa* Girault. The following new species of *Horismenus* was found in the collections of the United States National Museum when reviewing the North American Entedoninæ.

1. **Pseudomphale hypatia,** new species.

Female.—Length, 2.50 mm.

Differs from *lixivorus* Crawford in that the tibiæ are not dark, but merely embrowned centrally or brown except at tips; the stripe of scaliness across near apex of segment 2 of the abdomen is not so wide nor so produced proximad at lateral margin, the petiole is distinctly shorter and vertical, the abdomen subsessile, the median carina of the propodeum longer and broader. From *floridanus* Ashmead in the same particulars except the tibiæ, which are darker than in that species, brown, not white; also in *floridanus*, segment 2 of the abdomen is longer, slightly over half the length of that region (somewhat less than half in this new species); also the thorax is blue, not black. Differs from *microgaster* Ashmead in the shorter segment 2 of the abdomen. Runs close to *brasiliensis* Ashmead, but differs in the shorter abdominal

petiole, shorter segment 2 of the abdomen, which in *brasiliensis* occupies ¾ of the surface and is sculptured broadly distad, the median carina of the propodeum is broader and the pedicel longer, the tibiæ darker being brown. Compared with types of the named species except *microgaster*. Three ring-joints. Pedicel slightly longer than funicle 1.

Differs from the genotype in its dark femora, scape, etc. Described from three females labelled "*Ceroplastus novaesci*, Santiago, Chile, M. J. Rivera, Letter March 15, 1910."

Types.—Catalogue *No. 19320*, U. S. N. M., two females on tags (one a paratype). Parapsidal furrows half complete from caudad. Median groove of scutum delicate, only at proximal third.

Errata.—In my article "Geometrid Notes" in the Canadian Entomologist, Vol. XLVII No. 5, pp. 155-158, I wish to make the following corrections:—

P. 157, line 24, for "*paratype*" read "*paratypes*".

P. 157, line 28, for "*saawichata*" read "*saanichata*".

P. 158, line 29, for "*fuscata*" read "*furcata*".

P. 158, line 34, for "*saawichata*" read "*saanichata*".

L. W. Swett.

BOOK REVIEW.

Key to the Families of North American Insects.—An Introduction to the Classification of Insects. By Charles T. Brues, Assistant Professor of Economic Entomology, Harvard University, and A. L. Melander, Professor of Entomology, State College of Washington, Boston, Mass., and Pullman, Wash. Published by the Authors, 1915. 137 pp., 18 plates.

This little book brings together a complete analytical key to the orders and families of North American insects compiled from the works of the most recent authorities in the various branches of systematic entomology. Such a work has been a great desideratum among teachers of entomology in view of the rapid changes in the classification of insects which have been brought about in recent years as a result of the labours of an ever-increasing army of workers in this field.

The book "has been prepared to meet the requirements not alone of college courses in systematic entomology, but also of

agricultural high schools and of physicians, fruit inspectors, the modern farmer, the nature-lover, or anyone who is concerned with the practical identification of insects." It begins with a conspectus of the higher groups of insects down to the families, following which is a key to the orders, dealing with the earlier as well as the adult stages. The remainder of the text is occupied by short diagnoses of each order, followed in each case by dichotomous keys to the suborders, superfamilies and families. A few typical genera are mentioned in connection with each family, and when these contain well-known species of economic importance, both the scientific and common names of such species are given.

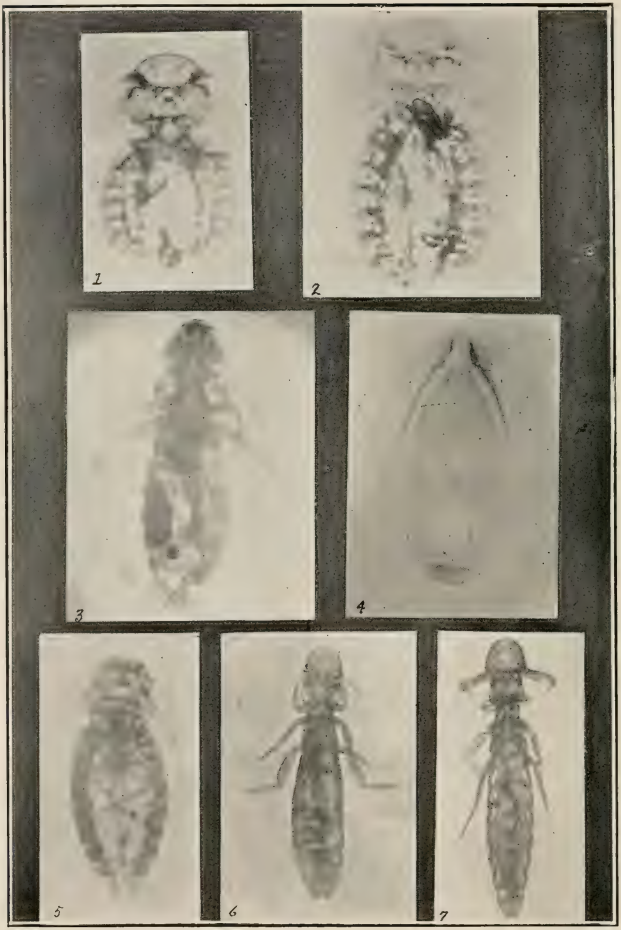
The book is copiously illustrated by 427 simple but excellent figures, showing the general appearance of members of typical genera or characters of taxonomic value.

The classification into orders and the grouping of these into subclasses and classes is essentially that of Handlirsch*, who recognizes five classes and divides one of these, the *Pterygogenea*, into 11 subclasses and 30 orders, there being 37 orders altogether. Only the orders and lower groups, however, are characterized in the keys. This system is undoubtedly based upon a much broader and more thorough consideration of all available data on the subject than any other hitherto proposed, and probably expresses the true relationships of the main groups of insects with correspondingly greater accuracy, and yet we cannot but think that the wisdom of following it in a manual such as this is open to question, at least in so far as its usefulness to the average teacher, or the physician or nature-lover is concerned, for it is far more complex than any of the older systems, and can only be appreciated by the most advanced students. For some reason, not apparent to the reviewer, the most generalized groups, usually known as the *Apterygota* or *Thysanura* and *Collembola*, but divided by Handlirsch into four classes, are placed at the end of the series, although the general sequence of groups is an ascending one.

The book also contains a glossary of special terms, an index to genera and higher groups, and an index to common names. It should certainly prove a most useful addition to any entomological or zoological library.

*Die fossilen Insekten und die Phylogenie der rezenten Formen. Leipzig 1908.

Mailed July 16th, 1915



LICE AFFECTING THE DOMESTIC FOWL.

The Canadian Entomologist.

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POPULAR AND ECONOMIC ENTOMOLOGY.

LICE AFFECTING THE DOMESTIC FOWL.

BY A. W. BAKER, GUELPH, ONT.

The lice affecting the Domestic Fowl are members of the order Mallophaga and are commonly called Biting or Bird Lice to distinguish them from the sucking lice of mammals. The name "Biting Lice" is applied because of the fact that the mouth-parts of the insects are fitted for biting. The food consists of bits of feathers and epidermal scales—the lice never feeding on the blood of the host save possibly where it may have dried around wounds. The injury to chickens arises from the irritation produced by the constant feeding and probably also to a considerable extent by the sharp claws.

The loss occasioned to poultry keepers through the attacks of lice is of course difficult of estimation, but it is certain that it is much greater than is usually supposed to be the case. The injury to chicks is especially great, proper growth being prevented through the restless activity of the bird. It is even quite possible that much of the mortality of small chicks is due directly to the attacks of lice. More mature birds are also prevented from making proper growth and egg-laying is doubtless checked to a considerable extent by the weakened and restless condition of the birds. Where setting hens are used there are often losses in hatching as a result of the abnormal activity of the bird. In addition to these direct losses birds as a result of their weakened condition are more susceptible to the various diseases to which poultry are at all times a prey.

One point which makes the biting lice of great importance as ectoparasites is that the whole life of the insect is passed on the body of the host. The female attaches her eggs to the feathers of the bird and each young louse escapes by pushing off a cap-like structure at the free end of the egg The rest of the life of the

louse is then spent on the body of this bird with the exception of course that migration may take place from bird to bird during contact on the perches or in nesting boxes.

Control Measures:

1.—Lice Powders.

There are many different lice powders on the market. Many are costly and some are not extremely effective. One of the most successful powders is that known as the "Lawry Lice Powder." This is not a proprietory powder and can be prepared cheaply by the poultry man. It will give extremely ssatisfactory results. This powder is made by adding to 3 parts of gasoline and 1 part of crude carbolic acid 90-95% enough plaster of paris to take up all the liquid. The plaster should be stirred in gradually so that a dry pinkish powder results.

This powder should be worked into the feathers of the bird especially on the more heavily infested parts of the body, that is in the region of the vent, wings and under side of the body. It must be borne in mind that this powder will not kill the eggs or "nits" of the lice, and it will accordingly be necessary to give another dusting and in severe cases even a third at intervals of 5-7 days, to kill those young lice which have hatched since the last dusting.

There are several grades of crude carbolic acid on the market. That of 90-95% must be used in the powder to obtain satisfactory results. The Poultry Department of the Maine Agricultural Experiment Station state that they have used cresol in place of the crude carbolic acid with good results where the carbolic could not be obtained.

2.—Blue Ointment.

Prof. W. R. Graham, of the Ontario Agricultural College, states that he has used Blue Ointment with success where setting hens are heavily infested with lice. The ointment is worked into the feathers of the bird by hand, but it must be used *sparingly and very carefully.*

3.—Dust Baths.

Baths containing a mixture of road dust and tobacco dust may be kept in the poultry house or in the run. Birds will make

free use of these baths and the chances of infestation will be to a great extent reduced.

It will be found advisable also where brood hens are used to set them on tobacco stems which may be obtained cheaply from any cigar factory. The possibilities of infestation of the chicks will thus be greatly reduced.

4.—Carbolized Sweet Oil.

Dusting young chicks will be found to be a difficult practice. Where head lice are very bad on young chicks it may be found necessary, however, to treat them. In this case a little carbolized Sweet Oil may be rubbed into the infested regions. The oil, however, must be used *only in extreme cases and then very sparingly*, as its use in any quantity may endanger the life of the chick.

A much surer method is to protect young birds from infestation by thoroughly treating all old birds with which they may come in contact.

5.—Disinfection of Houses.

If incubator and brooder-raised chicks are kept free from contact with old birds during their development, and are then placed in houses which have been thoroughly cleansed and disinfected, the danger of infestation is reduced to a minimum. Under these conditions any old birds which must be introduced into the house should, of course, be given two or three thorough dustings before they are allowed to run with the young birds.

Before the introduction of the young pullets the whole house, nests, perches, walls and floor should be thoroughly scraped and scrubbed and then well painted or sprayed with a mixture of 3 parts of Kerosene and 1 part of Crude Carbolic Acid 95%. This ensures absolutely lice-free surroundings for the young birds and also checks to a great extent, if it does not entirely eradicate, an infestation of red mites if such be present.

Following are the species of lice which are known to infest the Domestic Fowl in Canada with brief descriptions to aid in their identification.

The Common Hen Louse (*Menopon pallidum* N.).

This louse is about .04 to .06 inches in length. The body is compact, the head is long and the legs short. The abdomen

tapers strongly and regularly to the posterior end and is beset with numerous bristles. The whole body is a light straw colour.

This is in Canada as elsewhere the most common species affecting the Domestic Fowl. It can be readily recognized by its light yellow colour and extreme activity on the birds. It has been recorded in America also from the pigeon and is said by some to attack horses if such are in close proximity to lousy birds. The writer has never seen horses so attacked.

Menopon biseriatum Piaget.

This species is about .08 to .09 inches in length. The female has the body elongate and loosely jointed, the head short and the legs long. The abdomen tapers abruptly but slightly at the posterior end, and the posterior margin of the last segment bears a close series of fine hairs. The general body colour is yellowish brown. The male is shorter and stouter than the female and lacks the series of hairs on the posterior margin of the last segment. This species occurs commonly and often abundantly in company with *M. pallidum* It can readily be distinguished from the latter by its larger size and less compact form. It has been recorded in America also from the turkey and pigeon, and is said to attack the pea fowl.

The Variable Chicken Louse (*Lipeurus variabilis* N.).

The length of this species is about .09 to .095 inches. The body of the female is elongate and slender. The head is broadly rounded in front and the antennæ are slender with the first joint short. The legs are long and the abdomen tapers weakly from the sixth segment. The colour is whitish, the margins of the body and front margins of the legs being pitchy black. The abdominal segments each bear a large squarish median brown patch. The male is more slender than the female and the first joint of the antenna is very large, and bears a peg-like appendage as does also the third segment.

This species is quite common and can usually be found on any heavily infested flock.

The Lesser Chicken Louse (*Goniocotes hologaster* N.).

The length of this species is about .035 to .06 inches. The body of the female is very broad. The head is squared behind, the legs short and the abdomen regularly rounded behind. The colour is light yellowish brown. The abdomen of the male is much shorter and broader and squared behind.

This species is not common in Canada, though I have specimens taken at Guelph at various times. It has been recorded in the United States and I have received specimens from Prof. Haseman taken at Columbia, Mo.

EXPLANATION OF PLATE VIII.

1. *Goniocotes hologaster* N. ♂.
2. *Goniocotes hologaster* N. ♀.
3. *Menopon biseriatum* Piaget.
4. *Egg of a Bird Louse.*
5. *Menopon pallidum* N.
6. *Lipeurus variabilis* N. ♀.
7. *Lipeurus variabilis* N. ♂.

A NEW *HOPLANDROTHRIPS* (*THYSANOPTERA*) FROM BRITISH GUIANA.

BY J. DOUGLAS HOOD, U. S. BIOLOGICAL SURVEY.

The new species described below was received for determination from Mr. G. E. Bodkin, Government Economic Biologist of British Guiana.

Hoplandrothrips affinis, sp. nov.

Female (*macropterous*).—Length about 1.8 mm. Colour dark blackish brown with bright crimson hypodermal pigmentation; tarsi, fore tibiæ, and bases of antennal segments 3-6 lemon yellow; distal ends of mid and hind tibiæ and of tube paler; wings slightly

yellowish, with scale of fore wings and a short subbasal streak in hind wings, brown.

Fig. 26.—*Hoplandothrips affinis* Hood—1. Head and prothorax of female; holotype. 2. Right fore leg of male; Allotype. 3. Third segment of right antenna of female; holotype.

Head a little less than one and one-half times as long as wide and 1.5 times as long as prothorax, broadest at middle; cheeks rounded gently to eyes and to near base, thence nearly parallel, forming a neck which is narrower than greatest distance across eyes or about 0.86 the greatest width of head, set with a few small spines arising from slight tubercles, a pair at posterior sixth stronger; dorsal surface smooth and shining except at extreme base, which with the lateral surfaces is weakly subreticulate; vertex slightly and narrowly subconically produced, the anterior ocellus only

slightly overhanging; postocular bristles alone prominent, equal in length to eyes expanded at apex. Eyes $\frac{1}{3}$ as long as head, equal in width to their interval. Ocelli of posterior pair opposite middle of eyes and equal in size to anterior ocellus, which is slightly more distant. Antennæ about 1.6 times as long as head, moderately slender; segment 1 as broad as long; 2 about 1.7 times as long as wide, inner side straight, pedicel not curved outward; 4 very slightly longer and narrower than 3, clavate, pedicellate, narrowed at apex, broadest in advance of middle, about 1.8 times as long as wide; 5 almost similar in form to, but distinctly narrower and slightly shorter than, 4; about 2.1 times as long as wide; 6 clavate, more briefly pedicellate than 4 and 5, nearly 2.4 times as long as wide; 7 oblong, briefly pedicellate, truncate at apex and nearly 2.5 times as long as wide; 8 about three-fourths as long as 7, conical, more than three times as long as greatest width; segments 1 and 2 concolorous with head, 2 paler at middle of apex; 3 yellow, lightly infuscate in apical half; 4 yellow in basal two-fifths, brown beyond, slightly paler at apex; 5 yellow in basal third, brown beyond, slightly paler at apex; 6 yellow in basal fourth, beyond blackish brown, darker than 5; 7 and 8 blackish brown, pedicel of former paler; sense cones: 3, 1-2; 4, 2-2; 5, 1-1^{+1}; 6, 1-1^{+1}; 7 with one on dorsum near apex. Mouth cone short, broadly rounded, reaching only about half way across prosternum, labrum scarcely surpassing labium.

Prothorax about two-thirds as long as head and (inclusive of coxæ) about twice as wide as long; pronotum smooth; all usual bristles present, expanded apically, a little shorter than the postoculars. Wings slightly narrowed at middle; fore pair with scale brown, light yellowish beyond, six accessory hairs on posterior margin. Legs moderately slender; fore tarsus with a strong, slightly curved tooth.

Abdomen very slightly broader than pterothorax. Tube 0.6 as long as head, only about twice as long as greatest subbasal width, which is about 2.1 times the apical, sides straight. Lateral bristles expanded at apex, almost colourless; segment 9 with the

three long, pointed pairs; terminal bristles brown, about one and one-half times as long as tube.

Measurements of holotype: Length 1.76 mm.; head, length 0.274 mm., width 0.192 mm.; prothorax, length 0.180 mm., width (inclusive of coxæ) 0.366 mm.; pterothorax, width 0.372 mm.; abdomen, width 0.378 mm.; tube, length 0.168 mm.; width at base 0.081 mm., at apex, 0.038 mm.

Antennal segments	1	2	3	4	5	6	7	8
Length (μ)	42	35	66	69	64	59	54	42
Width (μ)	42	33	39	38	30	25	22	13

Total length of antenna, 0.431 mm.

Male (*macropterous*).—Length about 1.6 mm. Colour and structure essentially as in female. Genal spines a little stouter than in female. Antennæ 1.7 times as long as head, more slender. Tarsal tooth large, stout, curved. Abdomen slightly narrower than pterothorax. Tube about 0.54 as long as head, about twice as long as greatest subbasal width, which is about twice the apical, sides slightly concave. Segment 9 of abdomen with the lower lateral and the dorsal bristles longer than tube and pointed, the upper laterals very short (three-fifths as long as basal width of tube) stout, pointed, and dark in colour.

Measurements of allotype: Length 1.56 mm.; head, length 0.246 mm., width 0.168 mm.; prothorax; length 0.157 mm., width (inclusive of coxæ) 0.318 mm.; pterothorax, width 0.322 mm.; abdomen, width 0.284 mm.; tube, length 0.132 mm., width at base 0.068 mm., at apex 0.033 mm.

Antennal segments	1	2	3	4	5	6	7	8
Length (μ)	38	51	63	65	62	54	47	38
Width (μ)	38	30	36	34	27	23	20	11

Total length of antenna, 0.418 mm.

Described from one female and one male taken between leaf sheaths of sugar cane, at Rose Hall, Berbice, British Guiana, March 2, 1915, by G. E. Bodkin.

The only species of the genus recorded from South America.

MAYFLIES OF THE SIPHLONURUS GROUP.

BY WILBERT A. CLEMENS, ITHACA, N. Y.*

The nymphs of two interesting species of mayflies, *Siphlonurus* (*Siphlurus*) *mirus* Eaton and *Siphlonisca œrodromia* Needham, were handed me for description by Mr. C. P. Alexander, who successfully reared them during the summer of 1914 at Northampton, Fulton Co., N. Y. Before describing these nymphs, it seemed desirable to work over the material available in the Siphlonurus group, and the results of this work are given in the following paper.

The Name *Siphlonurus*.

The name *Siphlonurus* was proposed for a new genus by Eaton in the Ent. Mag., vol. 5, p. 89, 1868. The name was used again by Eaton in the Trans. Ent. Soc., London, 1870, p. 7. But in 1871 in the Trans. Ent. Soc., London, p. 125, the name *Siphlurus* is used and *Siphlonurus* (err.) Etn., 1868, given as a synonym. The name *Siphlonurus* was not preoccupied and therefore according to the International Code of Zoological Nomenclature, the first name used must stand and the name of the genus should be *Siphlonurus*.

New Genus.

In 1913 in the Can. Ent., vol. XLV, p. 338, I described a new species which I referred to the genus *Siphlonurus*. This species appeared to be nearest to this genus, and as I had no specimens of this genus with which to compare it, I decided to describe it as a *Siphlonurus* until other material was available for comparison. Now with such material at hand, I find this species shows characters of sufficient value for the erection of a new genus, and for this I propose the name *Siphloplecton* (defective-feeler, from the defective condition of the labial palpus).

Keys.

The generic keys which follow are simply those parts of the key published by Dr. Needham, Bull. 86, N. Y. State Mus., referring to the Siphlonurus group, modified to include the two genera since proposed.

*Contribution from the Limnological Laboratory of the Department of Entomology in Cornell University.

IMAGOS.

ff. The intercalaries between the first and second anal veins represented by a series of veinlets, often sinuous or forking, extending directly from the first anal to the wing margin (except in *Siphloplecton*); costal angulation of hind wing close to the base ; but two well developed caudal setæ, the median one being rudimentary or wanting; basal joint of hind tarsi evident but not well developed.

g. Median caudal seta a distinctly segmented rudiment; forceps of male three-jointed; posterior prolongation of sternum of ninth segment of abdomen of female bifid at tip.

h. Basal segment of fore tarsus of male shortest; claws of each tarsus unlike each to each; hind wing with the costal angulation acute, and the fork of the median vein occupying two-thirds the length of that vein..... *Coloburus*.

hh. Basal segment of fore tarsus of male longest; claws of each tarsus alike, hind wing with costal angulation obtuse, and the median vein forked through one-third its length ..... *Chirotenetes*

gg. Median caudal seta more rudimentary or wanting; forceps of the male distinctly four-jointed; sternum of the ninth abdominal segment not prolonged, or if so, entire at tip.

h. Cubitus 2 with a very pronounced curve at its base ..... *Siphloplecton*.

hh. Cubitus 2 without such pronounced curve at its base.

i. Segments 5-9 of abdomen with very broad lateral expansions (onisciform); mid-ventral, meso- and metathoracic spines ..... *Siphlonisca*.

ii. Segments 5-9 of abdomen without such broad expansions and thorax without ventral spines.

j. Claws of each tarsus alike; caudal setæ at least one-half longer than body ..... *Siphlonurus.*

jj. Claws of each tarsus unlike; caudal setæ about as long as the body ..... *Ameletus.*

NYMPHS.

e. Postero-lateral angles of the hinder abdominal segments prolonged into thin flat sharp lateral spines.

f. Fore legs conspicuously fringed with long hairs; gill-tuft present upon the bases of maxillæ and front coxæ and at bases of lamellæ on abdomen.....*Chirotenetes*

ff. Fore legs without conspicuous fringes; no maxillary or coxal gills; no gill-tufts at bases of lamellæ on abdomen.

g. Gills double on abdominal segments 1-3; claw of fore tarsus flattened and bifid; terminal segment of labial palpus wanting.....*Siphloplecton.*

gg. Gills not double on abdominal segments 1-3; claw of fore tarsus uncinate; labial palpus normal.

h. Abdominal segments with broad lateral expansions; mid-ventral meso- and metathoracic spines ..... *Siphlonisca.*

hh. Abdomen without such broad lateral expansions and thorax without ventral spines

i. Gills double on the first two abdominal segments; end of maxilla fringed with simple hairs.....*Siphlonurus*

ii. Gill lamellæ all single; end of maxilla fringed with pectinated hooks ..... *Ameletus*

KEY TO THE SPECIES OF *Siphlonurus.*

IMAGOS.

a. Wings clear, without clouded areas.

b. Venter with brown stripes, dots and streaks ..... *S. alternatus.*

bb. Venter with U-shaped brown marks.....*S. occidentalis.*

bbb. Venter with triangular brown marks ..... *S. triangularis.*

aa. Wings with clouded areas.

c. Venter with brown markings.

d. The hind wing wholly clouded with brown or almost so. Fore wing clear ..... *S. mirus*

dd. A small brownish cloud along the axillar fold of fore wing. Hind wing clear ..... *S. typicus*

cc. Venter transparent whitish.....*S. femoratus.*

NYMPHS.

a. Setæ dark-banded beyond middle.

b. Setæ dark-banded just beyond middle and again across the tips ..... *S. alternatus.*

bb. Setæ but once banded.

c. Venter with U-shaped dark areas; spines of the 9th abdominal segment just half the length of tergum of 10th segment in the median line ..... *S. occidentalis.*

cc. Venter with large dark triangular areas; spines of 9th abdominal segment slightly over half the length of tergum of the 10th segment in the median line ..... *S. triangularis.*

aa. Setæ unbanded ..... *S. mirus*

Siphlonurus alternatus Say.

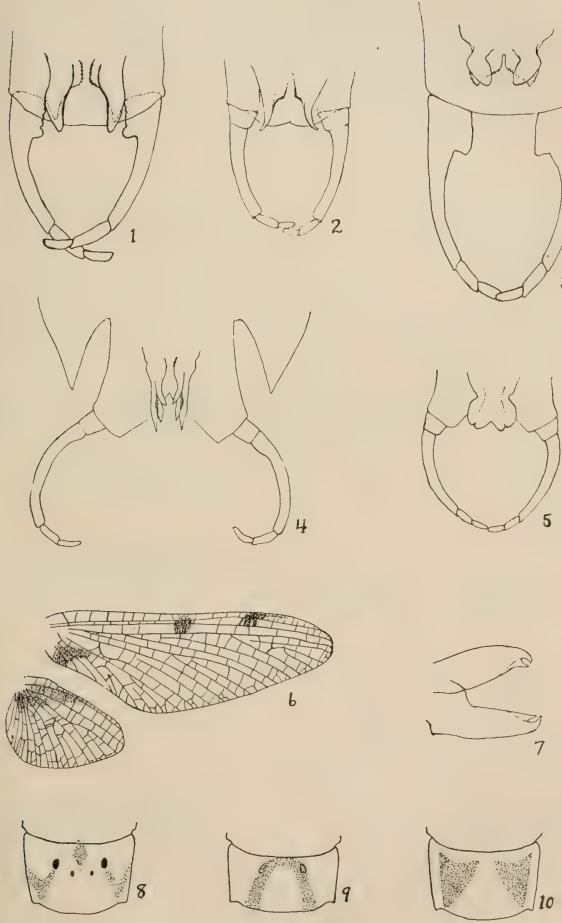
For description of adult see Eaton's Revisional Monograph, p 219, and of nymph, Bull. 47, N. Y. State Mus., 1901.

The nymph shows the same ventral abdominal markings as the adult. See Pl. IX, fig. 8.

Siphlonurus occidentalis Eaton.

The nymphs and adults of this species were taken by Professor T. D. A. Cockerell at Florissant, Colorado, June 30, 1907, at a place where subimagos were emerging in numbers. Other specimens were taken by Prof. Cockerell at Twin Lakes, Col., Upper Lake, July 14, 1902. See Pl. IX, fig. 9.

Nymph.—Length 13 mm.; leg 4.5 mm.; setæ 5 mm.



MAYFLIES OF THE SIPHLONURUS GROUP.

Structurally the nymph is very similar to that of *S. alternatus* except that the lateral abdominal spines are shorter. The setæ are but once banded and there is a very pronounced brownish band at the apical end of each tarsus.

The nymphs show the same U-shaped ventral abdominal brown markings as the adults.

Siphlonurus triangularis sp. nov.

Male subimago.—Length 12-13 mm. Head mostly deep brown, varied with whitish and yellowish irregular markings. Lower part of face transparent whitish. Thorax above deep brown; sides and ventral surface brown with white areas. Legs uniform light brown, but with darker markings on coxæ and trochanters at joints. Wings rather dull with light brown venation and without clouded areas. Dorsal surface of abdomen deep brown with a pair of lateral light areas on segments 2-7. Ventral surface of abdomen light brown with deep brown triangular areas, See Pl. IX., fig. 10. Lateral setæ 11-12 mm. long, the middle one rudimentary, showing 4-5 segments.

Female subimago.—Length 14-15 mm. Similar to male in coloration.

Female imago.—Length 15 mm; setæ 15 mm.; fore leg 8 mm. Middle and hind legs 6.5 mm. Very similar in coloration to the male subimago, but lighter and ventral markings of abdomen more pronounced. Wings clear, light brown venation, no clouded areas.

Nymph.—Length (mature) 12-15 mm.; setæ 5-6 mm.; leg 5 mm. General colour brown and white. Mouth-parts, see Pl. X, fig. 11-15. Thorax darker on upper surface. Legs whitish, banded with brown as follows: Femur with a basal brown band and another on apical fifth; tibia with a basal band, tarsus with basal and apical bands. Legs covered with numerous small spines and hairs; claws long, slightly curved and very pointed. Each segment of abdomen dorsally, except 1 and 10, usually light coloured in middle with brown band across basal margin from which project caudad two brown streaks. Each segment brownish toward the lateral margins, but with light areas in both anterior and posterior margins. A pair of very dark dots at posterior margin of each

MAYFLIES OF THE SIPHLONURUS GROUP.

segment. Segments of abdomen ventrally whitish with two somewhat triangular-shaped brown areas on each segment as in case of adult. The gills are of the typical Siphlonurus type. See Pl. X, fig. 11-15. Setæ once banded beyond middle.

This species is rather larger than *S. alternatus*. It was found emerging at Ithaca from June 5 to the 18th from a quiet spring-fed pond. This pond was very much grown up with aquatic vegetation, especially *Spirogyra*, and many of the nymphs were covered with colonial *Vorticellæ*.

Transformation.—The pond was about 40 ft. by 15 ft. with a maximum depth of about 2 ft., but the greater part of it only 6 in. or so. The water was very clear, so that the bottom could be seen in many places through the vegetation. The nymphs could be seen clambering about the water plants, swimming swiftly from place to place by means of the very efficient tail fin and gill lamellæ, or quietly clinging to some object, while the gills moved in gently undulating movements and the abdomen swayed up and down. Most of the nymphs were mature, and subimagos were continually flying up from the pond. One mature nymph swam about with its head up to the surface of the water as though looking for a suitable place for emergence, going from plants, to dead leaves and to twigs. It tried to climb upon a small twig, endeavouring to hang on with its legs and bending its abdomen and setæ around in its attempts to get up on top. It was almost successful, but suddenly abandoned the twig for a dead leaf. The leaf was only partly submerged and the nymph climbed up over the edge and up on top until only the abdomen was left in the water. Thus it remained quietly for two minutes with its gills in constant motion. It then crawled farther up the leaf until entirely out of the water, and remained quietly for about 3 minutes, when the body, especially the abdomen began to move convulsively, and in a couple of seconds the thorax split and the body of the subimago gently slid out over the surface of the leaf. When the legs were freed they were extended and at the same time the wings. Then the subimago took a few steps, leaving only the setæ still in the nymph slough.

It remained on the leaf for about four minutes, moving its legs and wings occasionally, and finally twisted and bent the abdomen

upward and freed the setæ. For six minutes more it stayed in the sunlight on the leaf, apparently getting accustomed to the new world into which it had emerged. Then it took flight, flying upward about thirty feet and coming to rest on a leaf of a tree near the pond. In the meantime three other nymphs emerged within two feet of the first one. One emerged on the side of an almost vertical leaf so that the subimago slid out partly on to the surface of the water and it had considerable difficulty freeing itself, but finally it succeeded and remained clinging to the leaf with its abdomen resting on the water for about six minutes. Its upward flight was accomplished without any difficulty. Another nymph crawled up a blade of grass at the edge of the pond. It took a little longer for this subimago to get out of the old nymph skin. There was a great abundance of life in the pond. Just a few sweeps of a small dipnet brought out salamanders, beetles, beetle larvæ, chironomid, mosquito, cranefly, and other dipterous larvæ, dragon-fly, and damsel-fly nymphs, and mayfly nymphs of the following genera: *Heptagenia*, *Ephemerella*, *Leptophlebia* and *Cloeon*.

No imagos were observed in flight and repeated trips to the vicinity of the pond for a week and at various times of the day from ten o'clock in the morning to nightfall, failed to find any imagos flying.

Siphlonurus mirus Eaton.

Male imago.—Length 12-14 mm.; setæ 18 mm.; fore leg 12-14 mm. Wing 12-13 mm. Head and thorax dark brown; a few lighter areas on sides of thorax. Legs uniform brown, a little darker at joints. Hind wing of male usually entirely brown as compared with the hind wing of the female, which is only about two-thirds brown. Each segment of the abdomen 2-9, dorsally light in colour with dark areas toward the lateral margin, along posterior margin and two streaks extending forward from posterior margin. Ventral surface with two lateral longitudinal bands on each segment and a darker area in middle. Genitalia, see Pl. IX, fig. 2.

Female imago.—See description, Eaton, p. 221.

Nymph.—Length 15 mm.; setæ 6-7 mm.; legs 5-6 mm. General colour brown. Head has a light area in front of the middle ocellus

and a very dark band from margin of this area to eye below antenna. Clypeus and labrum deep brown. Mouth-parts similar to those of *S. triangularis*. Thorax with light areas on ventral surface and sides. Legs light brown, unbanded but apical areas of tarsi darker. Dorsal surface of abdomen brown with a pair of blackish streaks about the middle of each segment, a blackish area lateral to each streak and a pair of black dots at the posterior margin of each segment. Ventral surface of the same general colour as dorsal surface with darker markings similarly arranged to those of adult. Setæ unbanded.

The following notes were given me by Mr. Alexander:

"Sport Island, Sacandaga River. Adults of *Siphlonurus mirus* Eaton, appeared on June 6, 1909, and were very common on the 12th. Seven specimens were taken home alive and three lived 51 hours."

See also under *Siphlonisca*.

Nymphs of *Siphlonurus femoratus* Say, *S. bicolor* Walker, and *S. typicus* Eaton have not been taken as yet, and adults of these species I have not had the opportunity of examining.

Siphlonisca Needham.

With more material at hand, including the nymph, the generic characters may be restated as follows:

Caudal setæ two, slightly longer than the body. Claws on all the legs (male and female) hooked and clawlike, and the two of each leg alike. Hind tibia longer than its tarsus, and last segment of tarsus longest. Female fore tibia about same length as its tarsus, last segment of tarsus the longest. Male fore tarsus about 3 times the length of its tibia, the last segment of the tarsus the shortest. Median and cubital veins in the fore wing symmetrically forked. No humeral angulation of hind wing. Mesothorax and metathorax each with a prominent midventral spine. Abdomen with conspicuous lateral expansions of the middle segments. No backward prolongation of 9th abdominal segment in female. Forceps base of male very broad; forceps 4-jointed and strongly divaricate.

The nymph has conspicuous lateral expansions to the segments of the abdomen and has prominent mid-ventral meso- and metathoracic spines. Gills on segments 1-7 and all single. The terminal segments of the labial and maxillary palpi pointed and the lateral lobes of the hypopharynx rounded.

Siphlonisca aerodromia Needham.

The description given in Bull. 134 N. Y. State Mus. errs in two minor points, namely, the claws of the fore leg of the female are normal, i.e., similar to those on the other legs, and there is a metathoracic mid-ventral spine as well as a mesothoracic one.

Nymph.—Length 19-20 mm.; setæ 8-9 mm.; legs 4.5 mm. General colour a dark brown. Antennæ longer than head, light in colour, but terminal joint tipped with dark brown. Mouth-parts, see Pl. IX, fig. 1-5. Thorax darker above. Prominent mid-ventral meso-and metathoracic spines. Legs comparatively short and stout. Tarsi and tibiæ of about equal length. Abdomen dark brown dorsally, tending to be darker along median line and along a line just inside the line of gills. Segments 5-9 greatly expanded laterally and each expansion produced backward into a spine. Two longitudinal lateral dark brown lines on ventral surface. Gills on segments 1-7 and all single, see Pl. IX, fig. 1-5. Three setæ, the middle one very slightly shorter than the outer ones, which are fringed on the inner sides only. Setæ brown, but with white tips.

Ecological Notes.—The following are Mr. Alexander's notes in regard to this species:

"The type specimen, a female, was taken on June 6, 1908, on rank vegetation at the south end of Sport Island in the Sacandaga River. Careful search on that day failed to locate other specimens."

"On June 6, 1909, at 5.20 p.m., there were scores of specimens flying over the bridge, several of these were in copulation and a large series of both sexes were taken. As it grew dark, the insects mounted higher in the air. At dusk the species could be distinguished high up in the air by the remarkable breadth of the abdomen. It is probable that the type taken in 1908 was the last

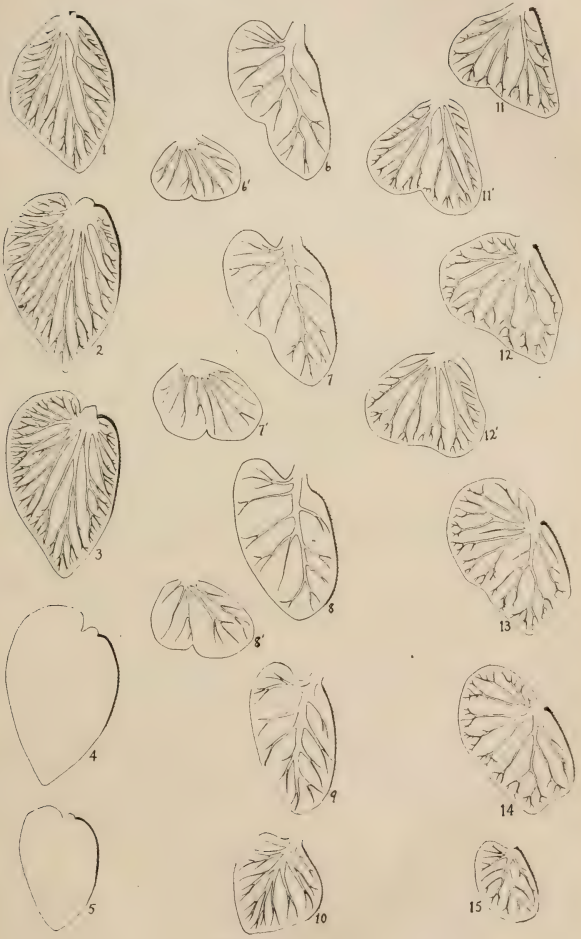
of that season's brood and the main emergence of the year took place in late May. This probably shows that the males die first, the females surviving longer in order to complete oviposition."

"The following field notes were made at Northampton (Fishhouse) in Fulton County, New York State, from May 25 to 29, 1914, where adults were reared from nymphs taken in small temporary pools left by the vernal overflow of the Sacandaga River:"

"*Siphlonisca* was first noted as a subimago in a tent-trap set on May 25th. The contents of the trap were examined on the following day and the catch included a subimago of *S. œrodromia*. After determining the habitat of the nymph, it was a simple matter to obtain the later stages. The nymphs crawl up the rush stems in order to emerge, usually leaving the cast skins three to four inches above the water level. Occasionally the cast skins are found on the upper surface of flat leaves."

"The nymphs of *Bœtisca obesa*, *Siphlurus mirus*, and *Siphlonisca œrodromia* occurred together in company with a great abundance of other mayfly nymphs of smaller and less conspicuous habit. The pools evaporated rapidly, and on May 27th, only two days after the first observations were made, had dwindled to one-half of their former size. The water became very warm and tepid towards midday, and this was more apparent each day as the amount of water decreased and the abundant animal life became more concentrated."

"Nymphs of the various mayflies were isolated and reared through to the imago. The most abundant species in the pools, with the exception of some of the smaller and less conspicuous species, was *Bœtisca obesa*. In an area of a few square yards, there were hundreds of cast skins of the species adhering to the rush stems long after the subimagoes had flown away. The cast skins of *Siphlonisca* were almost as common, on some of the rush stems there being as many as four of the cast skins on a single stalk, arranged end to end and crowding one another. *Bœtisca* was found to emerge at midday or slightly after, specimens being observed at 2 p.m. *Siphlonisca* came out at all hours of the day, but more abundantly in the late forenoon."



MAYFLIES OF THE SIPHLONURUS GROUP.

"By May 28th, the water in the temporary pools was entirely evaporated, but the larger mayfly nymphs had matured so rapidly or were timed so opportunely that not a single nymph was left. An immense number of the nymphs of smaller species and the plankton (a large red ostracod in great abundance; *Daphnia* and a great number of other Entomostraca; Planarians of two species, one being a small light green form; Mollusca, (*Aplexa hypnorum*, *Segmentina*, *Pisidium* sp.; etc.) of the pools were exposed and perished. The stench of their decaying bodies attracted many carrion-loving insects such as *Lucilia*, *Silpha inæqualis*, etc."

Siphloplecton gen. nov.

Caudal setæ two, middle one rudimentary. Fore tarsus of male with 2nd segment about equal to 1st, the 3rd slightly longer than 1st, the 4th slightly shorter than 1st, the 5th about half the length of 1st. Female fore tarsi 1, 2 (3 and 5) equal, 4. Hind tarsi of both male and female in order of decreasing lengths 1, (2 and 5) equal, 3, 4. Hind tibia shorter than its tarsus. Claws of each tarsus unlike. Wing without dependent intercalaries from the 1st anal, and cubitus 2 strongly curved at base. Penes lobes rounded with slight indentations. Sternum of ninth abdominal segment of female produced slightly and entire at tip.

Nymph with hind claws hooked and claw-like, but fore claws flattened and bifid. Labial palpus with but two segments. Gills double on segments 1, 2, and 3.

Type species—*Siphlurus flexus* Clemens (Can. Ent., 1913, vol. XLV, p. 338), Go Home Bay, Georgian Bay, Ont.

Besides the Georgian Bay material I have seen specimens from Douglas Lake, Michigan, Nov. 25, 1904, from Walnut Lake, Mich., April 12, 1906, and from the Michigan Agricultural College campus, East Lansing, Mich., July 15, 1910.

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1911—Morgan, Anna H.: Mayflies of Fall Creek. Ann. Ent. Soc. Amer. IV, p. 116.

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1913—Clemens, W. A.: New Species and life histories of Mayflies. Canad. Entomol. XLV, p. 338.

Explanation of Plates.

Plate IX.

Fig. 1.—Genitalia male *Siphlonurus occidentalis*.

Fig. 2.—Genitalia male *Siphlonurus mirus*.

Fig. 3.—Genitalia male *Siphlonurus alternatus*.

Fig. 4.—Genitalia male *Siphlonisca ærodromia*.

Fig. 5.—Genitalia male *Siphloplecton flexus*.

Fig. 6.—Wings *Siphloplecton flexus*.

Fig. 7.—Claws fore leg female *Siphlonisca ærodromia*.

Fig. 8.—Ventral colour-pattern on segment of abdomen of *S. alternatus*.

Fig. 9.—Ventral colour-pattern on segment of abdomen of *S. occidentalis*.

Fig. 10.—Ventral colour-pattern on segment of abdomen of *S. triangularis*.

PLATE X—Mouth-parts.

Fig. 1-5.—Labrum, maxilla, hypopharynx, mandible and labrum, respectively, of nymph of *Siphlonisca ærodromia*.

Fig 6-10 —Labrum, maxilla, hypopharynx, mandible and labrum, respectively, of *Siphloplecton flexus*.

Fig. 11-15.—Labrum, maxilla, hypopharynx, mandible and labrum, respectively, of *Siphlonurus triangularis*.

PLATE XI.—Gills.

Fig. 1-5.—Gills from Segments 1, 2, 3, 4 and 7, respectively, of right side of nymph of *Siphlonurus ærodromia*.

Fig. 6-10.—Gills from Segments 1, 2, 3, 4 and 7, respectively, of right side of nymph of *Siphloplecton flexus*.

Fig. 11-15.—Gills from Segments 1, 2, 3, 4 and 7, respectively, of right side of nymph of *Siphlonurus triangularis*.

A CONTRIBUTION TOWARDS THE TAXONOMY OF THE *DELPHACIDÆ*.

BY F. MUIR,
Hawaiian Sugar Planters' Experiment Station, Honolulu, T. H.

(Continued from Page 212.)

List of Genera.

1. *Achorótile* Fieber, 1866, Verh. Zool. Bot. Ges. Wien, XVI, 521; type *albosignata* (Dahlbom), Pl. VIII, f. 16.
2. *Aloha* Kirkaldy, 1904, Entom., XXXVII, 177; type *ipomoeæ* Kirk.; 1908, P. Haw. Ent. Soc., 1, Pl. IV, f. 9.
3. *Amblycotis* Stal, 1853, Ofv. Vet. Ak. Forh., 265; type *laticeps* Stal.
4. *Anectopia* Kirkaldy, 1907, H. S. P. A. Ent. Bull., 11, 143; type *mandane* Kirk., Pl. XI, f. 11-13, Pl. XIV, 4-6.
   Arcopus Spinola, 1839, Rev. Zool.; type *crassicornis* (Fabricius) Syn. *Delphax*.
5. *Arcofacies* Muir, gen. nov.
6. *Asiraca* Latreille, 1801, Hist. Nat. Crust. Ins., 111, 259; type *clavicornis* (Fabricius).
   Atropis Kirschbaum, 1868, Cicad. Wies. u. Frank., 10; type *latifrons* Kirsch—*lævifrons* Shlb. Syn. *Metropis* Fieb.
7. *Bakerella* Crawford, 1914, Pro. U. S. Nat. Mus., XLVI, 601; Pl. XLVII, f. D.
   Bambusaria Melichar, 1914, Phil. J. Sci., IX, 3, D. 274; Pl. I, f. 6, a-b.; type *picta* Mel.—Syn. *Sogatopsis pratti* Muir.
8. *Bambusibatus* Muir, gen. nov.
9. *Belocera* Muir, 1913, Pro. Haw. Ent Soc., II, 5, 239; type *sinensis* Muir., Pl VI, f. 4, a.
   Bergia Scott, 1881, E. M. M., XVIII, 155; type *nimbata* (Berg.) n. preoc. Syn. *Bergias*.
10. *Bergias* Kirkaldy, 1904, Entom., XXXVII, 279; nom. nov. for *Bergia*.
    Bidis Walker, 1856, J. Lin. Soc. Lond., Zool., I, 88; type *notivena* Walker, Pl. IV, f. 2. Syn. *Ugyops*.
11. *Bostæra* Ball, 1902, Can. Ent., XXXIV, 266; type *nasuta* Ball. Syn. *Cochise*.
12. *Calligypona* J. Sahlberg, 1871, Not. Sallsk. Faun. Fenn., XII, 408; type *albicollis* Sahlb.

13 *Canyra* Stal, 1862, Svensk. Vet. Ak. Hand., 3, No. 6, p. 7; type *placida* (Stal).

14. *Chloriona* Fieber, 1866, Verh. Zool. Bot. Ges. Wien, XVI, 519; type *unicolor* (H-S); Pl. VIII, f. 5.

15. *Chlorionidea* Low, 1885, Verh. Zool. Bot. Ges. Wien, XXXV, 356; type *flava* Low; Melichar, 1896, Cic. Mitt. Eur., Pl. IV, f. 23-25.

Cochise Kirkaldy, 1907, H. S. P. A. Ent. Bull. IV, 63; type *apacheanus* Kirk; Muir, 1913, P. Haw. Ent. Soc., II, 5; Pl. VI, f. 3, a. Syn. *Bostæra* Ball.

Cona White, 1879, E. M. M., XV, 218; type *celata* White, n. pr. Syn. *Micromasoria*

Conicoda Matsumura, 1900, Ent. Nachr., XXVI, 258; type *graminæ* Mats.—*brunnipennis* Sign. Syn. *Tropidocephala* (or a subgenus).

16. *Conomelus* Fieber, 1866, Verh. Zool. Bot. Ges. Wien, XVI, 520; type *limbata* (Fabricius), Pl. VIII, f. 10.

17. *Copicerus* Swartz, 1802, Kon. Vet. Nya. Hand, XXIII, 181; type *irroratus* Swartz; Pl. VI, f. 2, a-f; also Fowler, B. C. Amer., Hem.-Hom., I, Pl. XIII, f. 1, a, 2, a, Syn. *Holotus* Guerin.; *Jerala* Walker.

18. *Criomorphus* Curtis, 1833, Ent. Mag., I, 195; type *albomarginatus*. Curtis; Syn. *Ditropis* Kirsch; *Stiroma* Fieb.

19. *Delphacinus* Fieber, 1866, Verh. Zool. Bot. Ges. Wien, XVI, 520; type *nesomelas* (Boheman), Pl. VIII, f. 12.

Delphacissa (Subg. *Delphacodes* Fieb.), Kirkaldy, 1906, Can. Ent., XXXVIII, 155; type *uncinata* (Fieber).

Delphacodes (Subg. *Delphax-Liburnia*) Fieber, 1866, Verh. Zool. Bot. Ges. Wien, XVI, 524; type *mulsanti* Fieber, Pl. VIII, f. 32.

Delphacodes Melicher, 1901, Wien. ent. Zeit., 55; type *lethierryi* (Rey); n. pre. Syn. *Psendaræopus*.

20. *Delphax* Fabricius, 1798, Ent. Syst. Suppl., 511; type *crassicornis* Fab. Syn. *Aræopus* Spin.

21. *Dichoneura* Lethierry, 1890, A. Soc. Ent. Fr. (6) X 151; type *simoni* Lethierry.

22. *Dicranotropis* Fieber, 1866, Verh. Zool. Bot. Ges. Wien, XVI, 521; type *hamata* (Boh), Pl. VIII, f. 17 Syn. *Phacalastor* Kirk.

23. *Dictyophorodelphax* Swezey, 1907, Pro. Haw. Ent. Soc., I, 104; type *mirabilis* Swezey. Fig. op. c. II, p. 2.
Dictropis Kirschbaum, 1868, Cicad. Wies. Frank. (nec. Fieber) part. Syn. *Jassidæus crimorphus* and *Stiroma* Fieber. (Fieber used *Stiroma* in text and *Ditropis* on his plate and Kirschbaum followed the name on plate.)
Ectopiopterygodelphax Kirkaldy, 1906, H. S. P. A. Ent. Bull., I, 412; type *eximius* Kirk. Syn. *Tropidocephala.*

24. *Embolophora* Stal., 1853, Ofv. Vet. Ak. Forh., X, 265; type *monoceros* Stal.

25. *Eodelphax* Kirkaldy, 1901, Entom., XXXIV, 39; type *serendiba* Kirk. Syn. *Eudelphax setulosus* Mel.

26. *Eoeurysa* Muir, 1913. Pro. Haw. Ent. Soc., II, 249; type *flavocapitata,* Muir.

27. *Epeurysa* Matsumura, 1900, Ent. Nachr., 261; type *nawaii* Mats.

28. *Epibidis* Fowler, 1905, B. C. Amer., Hem.-Hom., I, 131; type *goodmani* Fowler, Pl. XIII, f. 3, a, b, 4-5.

29. *Eucanyra* Crawford, 1914, Pro. U. S. Nat. Mus., XLVI, 568; type *stigmata* Crawford, Pl. XLIV, f. G. N. R. S.
Eudelphax Melichar, 1903, Hom. Cey., 32 (Cixiidæ); type *setulosus* Mel., Pl. I, f. 6; Syn. *Eodelphax serendiba* Kirk.

30. *Euidella* Puton, 1886, Cat. Hem. Pal., 72; type *basilinea* (Germ.) n.n. for *Euides.*
Euides Fieber, 1866, Verh. Zool. Bot. Ges. Wien, XVI, 519; type *basilinea* (Germ). Fig of *speciosa* (Boh), Pl. VIII, f. 7. Syn. *Euidella,* n. pr.
Eueides Dallas, 1867, Zool. Rec., III, 560, Syn. *Euidella.*

31. *Eumetopina* Breddin, 1896, Deut. Ent. Zeit., 109; type *kruegeri* Bred.

32. *Eurybregma* Scott, 1875, E. M. M., XII, 92; type *nigrolineata* Scott (considered by some a syn. of *Criomorphus*).

33. *Eurysa* Fieber, Verh. Zool. Bot. Ges. Wien, XVI, 520; type *lineata* (Perr), figure Melichar Cic. Mitt. Eur., Pl. IV, f. 31-35.
Gadora Walker, 1858, Cat. Hom. Suppl. 84; type *capensis* Walker. Syn. *Hapalomelus flavipes* Stal.

34. *Gelastodelphax* Kirkaldy, 1906, H. S. P. A. Ent. Bull. I, 411; type *histrionicus* Kirk.; 1907, op. c., III, Pl. XVII, f. 1-3, Pl. XVIII, f. 16.

Geoneossus Muir, 1913, P. Haw. Ent. Soc., II, 238; type *sacchari* Muir., Pl. VI, f. 5-6. Syn. *Pseudaræopus* Kirk.

Goniolcium Foller, 1905, B. C. Amer. Het.-Hom., I, 132; type *granulosum* Fowler, Pl. XIII, f. 7-8. Syn. *Stobœra* Stal.

Hadeodelphax Kirkaldy, 1906, H. S. P. A. Ent. Bull., I, 410; type *pluto* Kirk.; 1907, op. c., III, Pl. XVII, F. 12. Syn. *Sardia* Mel.

35. *Hapalomelus* Stal, 1853, Of. Vet. Ak. Forh., 265; type *flavipes* Stal. Syn. *Gadora* Walker.

36. *Haplodelphax* Kirkaldy, 1907, H. S. P. A. Ent. Bull., III, 145; type *iuncicola* Kirkaldy, 1907, XII, f. 8-9.

Holotus (-Holatus) Guerin, 1856, de la Sagras Kist. Cuba, VII, and 1857, op. c., An. Artic., 429; type *thoracicus* Guerin. Syn. *Copicerus* Swartz.

37. *Idiosemus* Berg, 1883, Ann. Soc. Argentine, XVI, 233; type *xiphias* (Berg).

38. *Idiosystatus* Berg, 1883, Ann. Soc. Argen., XVI, 231; type *acutiuscula* (Spin.).

Ilburnia White, 1878, Pro. Zoo. Soc. Lond., 471; type *ignobilis* White (—Ilburnia Scudder, Nom. Zool., II, 160). Subgenus of *Liburnia*.

39. *Jassidæus* Fieber, 1866, Verh. Zool. Bot. Ges. Wien, XVI, 521; type *moris* Fieber. Pl. VIII, f. 13. Syn. *Ditropis* Kbm. prt. *lugubris* (Sign).

Jerala Walker, 1858, List. Hom. Suppl., 85; type *singula* Walker (—*Jeralia* Scudder Nom. Zool. II, 163) Syn. *Copicerus* Swartz.

40. *Kalpa* Distant, 1906, F. B. I. Rhyn., III, 474; type *aculeata* Dist. Fig. 261.

41. *Kelisa* Fieber, 1866, Verh. Zool. Bot. Ges. Wien, XVI, 519; type *guttula* (Germar); Pl. VIII, f. 4.

42. *Kormus* Fieber, 1866, Verh. Zool. Bot. Ges. Wien, XVI, 520; type *artemisiæ*; Fieber, Pl. VIII, f. 8.

43. *Laccocera* Van Duzee, 1897, Bull. Buff. Soc. Nat. Sci., V, 229 and 241; type *vittipennis* Van Duzee.

44. *Lanaphora* Muir, gen. nov.

45. *Leialoha* Kirkaldy, 1910, Faun. Haw. II (6), p. 579; type *naniicola* (Subgenus now erected to genus).

46. *Leimonodite* Kirkaldy, 1907, H. S. P. A. Ent. Bull., III, 133 (foot note); type *beckeri* (Fieber), Fig. Fieber, 1866, Verh. Zool. Bot. Ges. Wien, XVI, f. 17.
Lepticus Crawford, 1914, Pro. U. S. N. Mus., XLVI, 567. Erected on nymph.
47. *Liburnia* Stal, 1866, Hem. Afr., IV, 179; type *pellucida* (Fab.) Syn. *Delphax* Auct. nec Fabricius; *Delphacodes* s. g. Fieber. *Delphacissa* s. g. Kirkaldy.
48. *Liburniella* Crawford, 1914, Pro. U. S. Nat. Mus., XLVI, 585. Pls. XLV, f. T. XLVII, f. E.; XLIX f. N.
49. *Livatis* Stal, 1859, Eugen. Resa. Ins. 274; type *annulipes* (Stal), Pl. IV, f. 3.
50. *Macrotomella* Van Duzee, 1907, Bul. Buff. Soc. Nat. Sci., VIII, 44; type *caranata* Van Duzee
51 *Malaxa* Melichar, 1914, Phil. Jour. Sci., IX, 3, D 275; Pl. III, f. 7.
52. *Megamelanus* Ball, 1902, Can. Ent., XXXIV, 265; type *bicolor* Ball.
53. *Megamelus* Fieber, 1866, Verh. Zool. Bot. Ges. Wien, 519; type *notulus* (Germar). Pl. VIII f. 2.
54. *Melanesia* Kirkaldy, 1907, H. S. P. A. Ent. Bull., III, 128; type *pacifica* Kirkaldy. Pl. XVII f. 13-14.
55. *Mestus* Motschulsky, 1863, Bull. Soc. Nat. Mosc., XXXVI (3) III; type *morio* Motsch.
56. *Metropis* Fieber, 1866, Verh. Zool. Bot. Ges. Wien, XVI, 521; type *mayri* Fieber, Pl. VIII, f. 14. Syn. *Atropis*. Kirsch.
57. *Micromasoria* Kirkaldy, 1904, Entom., XXXVII, 279.; n.n. for *Cona;* type *celata* (White).
Nephropsia Costa, 1862, Ann. Mus. Zool. Nap., I, 76; type *elegans* (Costa). Syn. *Tropidocephala*.
58. *Nesodryas* Kirkaldy, 1908, P. Haw. Ent. Soc., I, 203; type *freycinetiæ* Kirkaldy.
59. *Nesopleias* Kirkaldy, 1910, Faun. Haw., II (6), 582; type *nimbata* Kirkaldy. Syn. *Aloha* in part, *Nesorestias* in part.
60. *Nesorestias* Kirkaldy, 1908, P. Haw. Ent. Soc., I, 205; *filicicola* Kirkaldy.
61. *Nesosydne* Kirkaldy, 1907, P. Haw. Ent. Soc., I, 161; type *koæ* Kirkaldy; fig. op. c. 1908, Pl. IV., f. 2.

62. *Nesothoe* Kirkaldy, 1908, P. Haw. Ent. Soc., I, 203; type *fletus* Kirkaldy.

63. *Nilaparvata* Distant, 1906, F. B. I. Rhyn., III, 473; type *greeni* Dist., f. 260.
Orchesma Melichar, 1903, Hom. Cey., 94; type *marginepunctata* Mll., Pl. III, f. 3, a-c. Syn. *Tropidocephala* (or Sub. gen.).

64. *Ostama* Walker, 1857, J. Lin. Sc. Lond., Zool., I, 151; type *juncta* Walker, Pl. 7, f. 4 a.

65. *Paranda* Melichar, 1903, Hom. Cey., 92; type *globiceps* Melichar, Pl. III, f. 10.

67. *Pentagramma* Van Duzee, 1898, Bull. Buff. Soc. Nat. Sci., V, 260; type *vittatifrons* (Uhl).

68. *Perigrinus* Kirkaldy, 1904, Entom. XXXVII, 175; type *maidis* (Ashmead); figure, Psyche, V, 1890, 323.

69. *Perimececera* Muir, 1913, P. Haw. Ent. Soc., II, 250; type *giffardi* Muir, Pl. VI, f. 13.

70. *Perkinsiella* Kirkaldy, 1903, Entom., XXXVI, 179; type *saccharicida* Kirkaldy. Figure H. S. P. A. Ent. Bull., I, Pl. XXVI, f. 1-8, Pl. XXVII, f. 1-4; op. c., III, Pl. XI, f. 5-8
Phacalastor Kirkaldy, 1906, H. S. P. A. Ent. Bull., I, 408; type *Pseudomaidis* Kirk. Syn. *Dicronotropis* Fieber.

71. *Phyllodinus* Van Duzee, 1898, Bull. Buf. Soc. Nat. Sci., V, 240; type *nervatus* Van Duzee.

72. *Pissonotus* Van Duzee, 1898, Bul. Buff. Soc. Nat. Sci., V, 236; type *marginatus* Van Duzee.

73. *Platybrachys* Bierman, 1910, Notes Leyden Mus., XXXIII, 41; type *platypoda* Dammerman.

74. *Prokelisia* Osborn, 1905, Ohio. Nat., 373; type *setigera* Osborn, f. I a-f.

75. *Proterosydne* Kirkaldy, 1907, H. S. P. A. Ent., Bull. III, 130; type *arborea* Kirkaldy, Pl. XVIII, f. 11-12.

76. *Pseudaræopus* Kirkaldy, 1904, Entom , XXXVII, 177 (foot note); type *lethierryi* (Rey) n. n. *Delphacodes*. Melichar (nec Fieber) n. pr. Figure Melichar, 1896, Cic. Mitt. Eur., Pl. III, f. 46; Syn. *Geonesssus* Muir.

77. *Punana* Muir, 1913, Pro. Haw. Ent. Soc., II, 249; type *brunnea* Muir.

78. *Pundaluoya* Kirkaldy, 1902, J. Bomb. Nat. Hist. Soc., XIV, 52; type *ernesti* (Kirby), figure Kirby, 1891, J. Linn. Soc. Lond. Zool., XXIV, Pl. V, f. 14; Melichar, 1903, Hom. Cey., Pl. II, f. 12 a-c.

79. *Purohita* Distant, 1906, F. B. I. Rhyn., III, 470; type *cervina* Distant, F. 257.

80. *Rhinotettix* Stal, 1853, Ofv. Vet. Ak. Forh., 1853, 265; type *fuscipennis* Stal.

81. *Saccharosydne* Kirkaldy, 1907, H. S. P. A. Ent. Bull., III, 139; type *saccharivora* (Westw), f. Westwood, 1833, A. M. N. H., 413, f. 54 a-c.

82. *Sardia* Melichar, 1903, Hom. Cey., 96; type *rostrata* Melichar, Pl. II, f. 4 a-b. Syn. *Hadeodelphax* Kirk.
Smara Distant, 1906, F. B. I. Rhyn., III, 478; type *festiva* Distant, F. 264, Syn. *Tropidocephala* Stal.

83. *Smicrotodelphax* Kirkaldy, 1906, H. S. P. A. Ent. Bull., I, 411 type *perkinsi* Kirkaldy; figure Kirkaldy, op. c., III, Pl. XVI, f. 14-16; Pl. XVIII, f. 14.

84. *Sogota* Distant, 1906, F. B. I. Rhyn., III, 471; type *dohertyi* Distant, f. 258.

85. *Sogatopsis* Muir, 1913, P. Haw. Ent. Soc. II, 247; type *pratti* Muir; Syn. *Bambusaria picta* Mel.

86. *Sparnia* Stal, 1862, Sve. Vet. Sk. Hand, III, p. 6.

87. *Stenocranus* Fieber, 1866, Verh. Zool. Bot. Ges. Wien, XVI, 519; type *minutus* (Fab.), Pl. VIII, f. 3.
Stiroma Fieber, 1866, Verh. Zool. Bot. Ges. Wien, XVI, 521; type *mœsta* (Bohman). Syn. *Criomorphus* (Fieber's figure 18 is marked *Ditropis*).

88. *Stobœra* Stal, 1859, Berl. Ent. Zeit., III, 327; type *concinna* (Stal); Syn. *Goniolcium* Fowler.

89 *Toya* Distant, 1906, F. B. I. Rhyn., III, 472; type *attenuata* Distant, F. 259.

90. *Tropidocephala* Stal, 1853, Ofv. Vet. Ak. Forh., 266; type *flaviceps* Stal. Syns. *Conicoda* Mats.; *Ectopiopterygodelphax* Kirk.; *Nephropsis* Costa; *Orchesma* Mel.

91. *Ugyops* Guerin, 1834, Voy. Belanger, Zool., 477; type *percheronii* Guerin, Syn. *Hygyops, Hygiops; Bidis* Walker.

92. *Upachara* Distant, 1906, F. B. I. Rhyn., III, 469; type *stigma Distant*, f. 256.

93. *Zuleika* Distant, 1912, A. M. N. H. (8) IX 198; type *bengalensis* Dist.

TABLE OF GENERA.

1. Fulgorids, with movable spur on hind tibiæ.....*Delphacidæ*.
2 (3) Post-tibial spur subulate, with cross section either circular or angular, apex more or less acuminate, without teeth on side ..... *Asiracinæ*.
3 (2) Post-tibial spur, cultrate or subcultrate or laminate, with or without teeth on hind edge.....*Delphacinæ*.

ASIRACINÆ.

1 (2) First femora and tibiæ foliaceous.....*Asiraca*
2 (1) First femora and tibiæ simple or only slightly flattened.
3 (6) Three mesonotal carinæ.
4 (5) Antennæ cylindrical or subcylindrical..... *Malaxa*, *Ostama*
5 (4) Antennæ, with both joints foliaceous.....*Copicerus*
6 (3) More than three mesonotal carinæ.
7 (8) Four mesonotal carinæ..... *Idiosemus*.
8 (7) Five mesonotal carinæ.
9 (10) First joint of antennæ cylindrical, shorter than second, second joint ovate and considerably flattened; face with two median carinæ.....*Punana*.
10 (9) Both joints of antennæ cylindrical or subcylindrical.
11 (12) Antennæ with "articulo secundo supra sulcato".....*Canyra*.
12 (11) Second joint of antennæ not sulcate.
13 (22) Face with two medio-longitudinal carinæ.
14 (17) Face much longer than broad.
15 (16) Second joint of antennæ more than three times the length of first ..... *Perimececera*.
16 (15) Second joint of antennæ less than three times the length of first ..... *Ugyops*
17 (14) Face about as broad as long, second joint of antennæ about twice the length of first.
18 (19) Medio-longitudinal carinæ of face arcuate, nearer together at apex and base than at middle.....*Pentagramma*
19 (18) Medio-longitudinal carinæ of face "slightly widening from the lower margin of the frons to apex."

20 (21) Clypeus with median carina.....*Bergias.*
21 (20) Clypeus without median carina.....*Idiosystatus.*
22 (13) Face with one medio-longitudinal carina, furcate or simple.
23 (24) First joint of antennæ less than half the length of second (second joint slightly flattened).....*Melanesia.*
24 (23) Joints of antennæ subequal or first, but slightly shorter than second.
25 (26) Medio-longitudinal carina of face simple.....*Eucanyra.*
26 (25) Medio-longitudinal carina of face furcate.
27 (28) First joint of antennæ considerably shorter than second ..... *Ugyops.*
28 (27) First joint of antennæ but slightly shorter than second ..... *Epibidis.*

Delphacinæ.

Post-tibial spur cultrate, solid, both surfaces convex, distinct teeth along the hind edge.....*Alohini*
Post-tibial spur cultrate, solid but with inner surface concave; no teeth along hind edge.....*Tropidocephalini*
Post-tibial spur laminate or foliaceous, sometimes tectiform, with or without teeth along hind edge ..... *Delphacini*

Alohini.

1 (4) First joint of antennæ very short, broader than long; second joint short and thick, often ovaliform or subovaliform (all macropterous).
2 (3) Two median frontal carinæ, approximating at base or apex, or both, or even meeting together, but not forming a stalk ..... *Leialoha.*
3 (2) A single median frontal carina, forked at extreme base, if at all ..... *Nesodryas.*
a Slender, elongate forms.....Subgenus *Nesodryas*
b Broader, more robust forms.....Subgenus *Nesothoe*
4 (1) First joint of antennæ distinctly longer than broad, second joint cylindrical or only slightly enlarged at middle (few macropterous, most brachypterous).
5 (8) Two median frontal carinæ.

6 (7) Tegmina reaching well beyond middle of abdomen *Aloha.*
7 (6) Tegmina very short, not reaching to middle of abdomen *Nesorestias.*
8 (5) One median frontal carina, forked or simple.
9 (10) Head enormously elongate, longer than thorax and abdomen combined *Dictyophorodelphax*
10 (9) Head not elongate.
11 (12) Mesonotum with rounded disk, a depression dividing the disk from the posterior angle *Proterosydne.*
12 (11) Mesonotum with flattened disk, no distinct depression dividing the disk from posterior angle *Nesosydne*

TROPIDOCEPHALINI.

1 (8) Lateral carinæ of vertex and face only moderately developed.
2 (7) First joint of antennæ terete, or if at all flattened than longer than wide with lateral edges sub-parallel.
3 (4) Vertex turbinate (triangular with curved sides), sometimes considerably elongate; lateral edges of face arcuate; antennæ very much shorter than face, first joint annular, second about twice the length of first *Tropidocephala.*
4 (3) Vertex quadrate.
5 (6) Antennæ slightly longer than face, joints subequal in length, first slightly flattened; lateral edges of face straight, subparallel; length of vertex equal to width at base; in profile clypeus not bent at right angle to face *Sogatopsis.*
6 (5) Antennæ about length of face, first joint terete, about 2-3 length of second; lateral carinæ of face arcuate; in profile clypeus bent at right angle to face *Arcofacies.*
7 (2) First joint of antennæ subsagittate, broader at apex than base, only a little longer than wide *Bambusibatus.*
8 (11) Lateral carinæ of vertex and face forming deep keels.
9 (10) First joint of antennæ about equal to second, not foliaceous *Lanaphora*
10 (9) First joint of antennæ much longer than second, flattened, foliaceous *Purohita.*

(To be continued.)

ON THE EARLY STAGES OF TWO MOTHS.

BY WM. BARNES AND J. MCDUNNOUGH, DECATUR, ILL.

Apantesis michabo Grt.

Eggs of this species were received early in the spring from Southern Pines, N. C. They were laid in small patches of from 30-40 ova in one patch and were similar to those of *A. arge*. The larvæ fed up quickly on lettuce and dandelion. It was noticeable that the larvæ producing the male moths underwent one less moult than those producing the female; on account of this extra moult the female larvæ were considerably smaller than the male ones in the fourth and fifth stages, but when full grown were much larger.

Stage I.—Head black. Body pale greyish with large black tubercles similar in arrangement to those of our sketch (Can. Ent., 44, p. 133, 1912). Prothoracic plate brownish, rounded posteriorly, with four long black equidistant setæ on anterior margin and two similar setæ on posterior margin situated one on each side of the centro-dorsal line; laterad to each of these is a minute white seta. Posterior to the outer corner of the prothoracic plate is a minute white seta situated on a small chitinous patch; laterad to this plate, on the anterior margin of the segment, is a larger chitinous patch with two black setæ, below which again are two small white setæ on a small chitinous area. On the meso- and metathorax the two setæ of tubercles I. and the single seta of III are black, all the others white and shorter than the black ones; tubercle IV situated laterad and posterior to III, small; on the first eight abdominal segments the seta of tubercle II and the upper one of III are black, the setæ of the other tubercles and the lower one of III being white; tubercle I minute. On the 9th abdominal segment two large dorsal tubercles contain each 4 setæ and the anal plate is shield-shaped with four short setæ on each side of the centro-dorsal line.

Stage II.—Head black with the sutures of the clypeus strongly marked in white. Body black-brown dorsally, shading into light brown laterally; a broad dorsal whitish stripe, a narrower subdorsal one above tubercle III and a slightly waved subspiracular one between tubercles IV and V. The tubercles are black and

show a considerable augmentation of setæ, of which a single black central one from each dorsal tubercle is very long, the individual setæ thus forming a double dorsal row, the hairs increasing in length towards the anal segments where they are pointed rearwards and tend to become white in the upper half; the central seta of tubercle III is almost as long and these form a similar lateral row pointing sidewards. Besides these long black setæ on the meso- and metathorax tubercle I has 3 shorter black setæ and several minute white ones; tubercle III has three white setæ; tubercle IV of the previous stage is only represented by a faint chitinous patch, but immediately below it and posterior to V is a minute white seta; tubercles V and VII have each about 5 white setæ. On the prothorax the prothoracic plate has the setæ on the anterior margin arranged in two groups, each containing four black setæ, pointing forwards, and several shorter white ones; the setæ of the posterior margin are as in the preceding stage with the addition of two minute white ones behind the two central black setæ. Behind the corner of the plate are two small white setæ; the lateral tubercle on the anterior margin is large with two long black setæ and 4 or 5 short white ones, laterad to this is a tubercle with one central black and 4 white setæ.

On the abdominal segments tubercle I has a single short white seta, tubercle II 5 black setæ grouped around the long central one, with occasional white setæ intermingled; tubercle III with a longer black seta and 5 short white ones which tend to become blackish on the rear segments; the other lateral tubercles with about 4 or 5 white setæ each.

Stage III.—Head as before. Body with dorsal area black, shading into paler laterally, with velvety black patches on anterior dorsal portion of each segment and along edge of centro-dorsal stripe which is broad and whitish-yellow; subdorsal stripe as before, but tending to break up into spots; lateral area browner than the dorsal area, mottled with ochreous around base of tubercle III and with pale subspiracular band as before.

Prothoracic plate with two well marked anterior warts each containing numerous long black and shorter white setæ pointed forwards; the posterior row of setæ consists of 4 black ones with

the central two accompanied each by two short white setæ and the outer two each by a single one. Warts large, black, with numerous setæ, of which the double dorsal row and the lateral row of long black ones is still present, these hairs tending to become white towards their apices; besides these tubercle III has a single very long white hair pointing sideways. The dorsal setæ are mostly black and tubercle II contains about 12, arranged in two concentric rows around the long central seta; tubercle I is small with three short whitish setæ; the lateral tubercles contain each 10-12 white setæ. On the meso- and metathorax tubercle IV is again represented by a single short seta, whilst below it the secondary tubercle now contains two white setæ.

Stage IV.—Head as before. Body dull black blotched dorsally with velvety black; warts black; a broad pale yellow dorsal stripe often considerably tinged with orange; subdorsal stripe reduced to round white spots on anterior portion of each segment, occasionally lengthened posteriorly; a subspiracular waved white stripe; legs and prolegs pale orange; spiracle ochreous ringed with black; setæ much as before, but greatly increased in number, the long dorsal setæ are now whitish in colour and besides these there are several rather long black ones from tubercle II, the remainder being considerably shorter; tubercle III with the very long white seta pointing outwards and the shorter black one pointing upwards as in preceding stage; all lateral setæ white.

Stage V.—Much as in the preceding stage; the dorsal stripe often assumes a more orange hue whilst the subdorsal row of dots remains white and is occasionally almost wanting; the subspiracular stripe is overlaid with smoky and not so sharply defined as in previous stages; apart from the subspiracular ones the setae are mostly dull black and only very slightly barbed, any white ones occurring on the dorsal and supraspiracular tubercles being very short. The orange central portion of the spiracle often tends to become obscure. This is the final stage for the male larva.

Stage VI (♀)—Practically as in the preceding stage with a considerable increase in size. The full grown larva may be at once distinguished from that of *argc* by its blacker body colour and the lack of the continuous subdorsal stripe which in *michabo* is reduced to small spots. Dr. Dyar (Jour. N. Y. Ent. Soc. VIII,

36) has recorded 7 stages for the ♀ larva of *argc*, spring brood; we are practically certain that we have missed no stage in our brood of *michabo*, so if the number of moults is constant, it would form a further means of differentiation between the two species. Of the two *michabo* would seem to be the newer species, being a further development of the *argc* type, as the subdorsal line is present in the earlier stages only, being obsolescent or wanting in the mature larva.

Acronycta impressa Wlk.

We use this name in the ordinarily accepted sense, i.e. for the species as figured by Smith in his Monograph of the genus *Acronycta*, Pl. XIII, figs. 4 and 5, and of which *verrilli* G. & R. is regarded as a synonym. The type of *impressa* Walker in the British Museum is in such poor condition that on a recent examination we were unable to tell definitely to just what form the name should be applied; until material from the type locality is available, more or less doubt will surround the application of the name. We received ova of the species late in the fall of 1914 from New Washington, Pa.; the larvæ fed up readily on poplar and pupated within a month from the time of emergence from the egg. Two ♀'s emerged the same fall, the remainder of the pupæ hibernated and produced imagines early the following spring.

Ovum.—Rather flat, base of egg broad, irregularly circular, about 1 mm. in diameter, with a slight rim around the periphery; from this rib arise 50-60 ribs, arranged more or less in pairs, which ascend the sides of the egg about half way to the micropylar area where the two component parts of each pair join and are either continued to the micropylar area by a single rib or else end blindly; occasionally the upper ends of two pairs are joined by the single rib. Colour when first laid yellow, becoming later purple with numerous white blotches and finally almost black.

Stage I.—Head shiny black; body white with abdominal segments I, IV, V and VIII deep black-brown to below the spiracles: traces of a dark dorsal stripe especially on segments preceding and following the dark ones; on the white segments traces of a lateral brown band situated above tubercle VI on a level with the lower edge of the dark colour of the four above mentioned abdo-

minal segments. Prothoracic plate black with about eight long setæ projecting forward; tubercles large, shiny black, the dorsal thoracic tubercles with about 3 long setæ and the abdominal ones with about six; all the lateral tubercles bear single black setæ, tubercle IV being small with very minute seta. Length 2 mm.

Stage II.—Head shiny black. Body white with abdominal segments I, IV, V and VIII deep black brown as before, at times shaded dorsally with yellowish; a lateral brown band with the upper edge situated on a level with tubercle III, slightly mottled with white, and with the tubercles contained in this band ringed with white basally; this white area around tubercle V tends to spread laterally forming a more or less consecutive white subspiracular line. On the flange in some cases is a brown dorsal band with central white line, in other cases this band is lacking and the general colour appears in consequence lighter. Tubercles shiny black, large, except IV, situated immediately posterior to the spiracle, which is minute with a single seta; the number of setæ have greatly increased, tubercle I bearing about 12 stiff black bristles and the other tubercles 6-8 similar ones. Length 4 mm.

Stage III.—Head black. Body largely deep black-brown, abdominal segments I, IV, V and VIII entirely so, the other segments with an orange-yellow subdorsal stripe occupying the area between the lower portion of tubercle I and the upper portion of tubercle III; some specimens show a slight white marbling both laterally and dorsally on the dark ground colour. Lateral tubercles strongly ringed with white, forming, as in previous stage, a broken subspiracular line on a level with tubercle V; on the dark segments tubercle II is also white ringed and at times tubercle I shows traces of white at the base; tubercles as before, the dorsal ones with numerous black stiff bristles and a few slight white ones around the bases, the lateral ones with several central black setæ and numerous white ones; from the prothoracic shield numerous white hairs overhang the head. The segmental incisions are well marked, abdominal segments I and VIII being noticeably humped. Length 9 mm.

Stage IV.—A considerable change in the general appearance. Head black Body black with orange subdorsal line on the seg-

ments corresponding to the pale segments of the previous stages and a whitish subspiracular line as before; tubercles large, black, prominently white-ringed; spiracle ringed with white. On the first four segments the dorsal hairs are red-brown paling to white laterally, the red-brown colour occasionally extending over to abdominal segments II and III, on the other segments all the hairs are white with the exception of a few black hairs on the 8th abdominal segment which is markedly humped; several long white hairs arise from the lateral tubercles, these being pointed forwards on the anterior segments and backwards on the anal segments. Length 12 mm.

Stage V.—Head black. Body velvety black; all trace of the orange subdorsal stripe is lost and the white subspiracular line and rings round the tubercles greatly reduced, when present the former being orange-tinged. Hairs whitish-yellow except on the meso- and metathoracic and 1st abdominal segments where the whole area above the spiracle shows red-brown hairs which often extend dorsally on to the 2nd and 3rd abdominal segments; occasionally similar hairs are found dorsally on the 8th abdominal segment which scarcely ever shows any black setæ as in previous stage; the tubercles from which these reddish hairs arise are slightly tinged with red-brown and the other tubercles are mostly black occasionally tinged with whitish. Spiracle white.

Width of head 1.8 mm. Length 18 mm.

Stage VI (full grown).—Very much as in preceding stage, quite variable in coloration. Head black. Body velvety black with white spiracles and with reddish subspiracular line either slightly present or entirely lacking or confined to the base of tubercle V. Hairs ranging in colour from pure white to yellowish, the dorsal hairs being usually rather stunted and crinkly; red-brown hairing as in preceding stage on the anterior segments except prothorax and extending dorsally to 2nd and 3rd abdominal segments and frequently with similar hairs dorsally on 8th and 9th abdominal segments; the tubercles bearing the red-brown hairs are usually themselves similarly coloured, whilst the others may be black shaded with white or entirely white and frequently the lateral abdominal ones are entirely black. Length 25-30 mm.

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POPULAR AND ECONOMIC ENTOMOLOGY.

SOME CURIOUS OLD BELIEFS ABOUT INSECTS.

BY HARRY B. WEISS, NEW BRUNSWICK, N. J.

"Oft from the putrid gore of cattle slain
Bees have been bred . . . . A narrow place,
And for that use contracted, first they choose,
Then more contract it, in a narrower room,
Wall'd round, and covered with a low built roof,
And add four windows, of a slanting light
From the four winds. A bullock then is sought,
His horns just bending in their second year;
Him, much reluctant, with o'erpowering force,
They bind; his mouth and nostrils stop, and all
The avenues of respiration close:
And buffet him to death: his hide no wound
Receives; his battered entrails burst within,
Thus spent they leave him, and beneath his sides
Lay shreds of boughs, fresh lavender and thyme.
This, when soft zephyr's breeze first curls the wave,
And prattling swallows hang their nests on high.
Meanwhile the juices in the tender bones
Heated, ferment; and wondrous to behold,
Small animals in clusters, thick are seen,
Short of their legs at first; on filmy wings,
Humming at length they rise; and more and more
Fan the thin air; 't ll numberless as drops
Pour'd down in rain from summer clouds, they fly."

Such is the fabulous, poetic method given by Virgil in his Georgics for generating a swarm of bees. These erroneous ideas of ancient naturalists, philosophers and poets were not by any means confined to insects. For instance, Kircher, a learned man

of the 17th Century gave the following recipe for the manufacture of snakes: "Take some snakes, roast them and cut them in small pieces—then sow those pieces in an oleaginous soil; then from day to day sprinkle them lightly with water from a watering pot, taking care that the piece of ground be exposed to the spring sun, and in eight days you will see the earth strewn with little worms, which, being nourished with milk diluted with water, will gradually increase in size till they take the form of perfect serpents."

Other investigators who tried this method succeeded, of course, only in raising large broods of flies. Kircher noted flies also, but explained their presence by saying that they were "engendered from that substance which constituted the aliment of the snakes."

For restoring dead bees to life, Columella, a Roman writer, recommended that the dead bees be kept until spring and then exposed to the sun among the ashes of the fig tree properly pulverized. Another fanciful statement concerning bees is that of Aristotle, who said that the olive, the cerinthus, and other plants, had the property of generating young bees from their purest juices. Quoting Virgil again on bees, we have these lines:

"From herbs and fragrant flowers, with their mouths
They cull their young."

The peculiar stalked eggs of the lace-winged fly (*Chrysopa* sp.) were at one time described as fungi, but this, however, is not surprising when one considers their peculiar appearance. "Minute insects flying in the air" were supposed to have some connection with intestinal worms in man, and a blight was at one time described as "an easterly wind attended by a blue mist." the easterly wind being loaded with aphids and the eggs of various destructive insects. Electric changes in the air were thought by some to be responsible for honey dew, and Linnæus thought that the honey dew on hop leaves was due to the caterpillar of the ghost moth (*Hepialus humuli*) attacking the roots.

Coming to insect transformations, Heroldt explained this in a novel way. He stated that "the blood of caterpillars is the only original portion of them, which, being endowed with a formative power, produces an envelope for itself of mucous net-work, and this again by means of a similar power is successively transmuted into the caterpillar, the pupa and the perfect insect."

According to Swammerdam, the hairs on the tip of the breathing tube and end of the body of a mosquito larva are anointed with oil so as to repel water. He also remarks that this oil is removed when the larva is roughly handled. Harvey, who discovered the circulation of the blood, made the statement that "bees, wasps, hornets, or butterflies, and whatever other animals are generated by metamorphosis from a creeping insect, are offspring of chance, and therefore never to keep up their species."

Baster thought that the spiracles of insects were their organs of smell, and this opinion was also held by Cuvier, Dumeril and Lehmann, Cuvier believing that the lining of the tracheæ were constructed to receive stimuli. The old superstitions connected with certain wood-boring beetles and their tappings, known as the "death watch," prompted Swift to write the following lines:

"A wood worm
That lies in old wood, like a hare in her form,
With teeth or with claws it will bite, it will scratch;
And chambermaids christen this worm a death watch;
Because like a watch it always cries click.
Then woe be to those in the house that are sick,
For sure as a gun, they will give up the ghost,
If the maggot cries click when it scratches the post.
But a kettle of scalding hot water injected,
Infallibly cures the timber affected;
The omen is broken, the danger is over,
The maggot will die and the sick will recover."

In 1730, during a severe outbreak of the Brown-tail Moth in the vicinity of Paris, the French journalists stated that part of the caterpillars were produced by spiders, and that these spiders, and not the caterpillars, produced the webs from the slime of snails, which they were said to have been seen collecting for that purpose. A more garbled idea than this it would be hard to invent. The outbreak was so severe at that time that the city officials of Paris issued an order compelling the people to "uncaterpillar" (dechenille) their trees. Cold rains, however, produced so much mortality among the larvæ that it was not necessary to enforce the order.

And so on, through all of the pages of early entomology, run these curious beliefs and fascinating old accounts of insects.

SUNFLOWER INSECTS.

BY T. D. A. COCKERELL, BOULDER, COLORADO.

I am much indebted to Mr. R. L. Thompson for the following information regarding sunflower insects observed at Salisbury, Rhodesia:

"As yet we have no record of any serious pest attacking sunflowers in Southern Rhodesia, and the nearest approach to injury that has come under my notice was a partial defoliation of a few plants at the Experimental Station, Salisbury, by the larvæ of *Plusia orichalcea*. In this case the plants rapidly recovered, and no injury to the flower heads was apparent. The only other injury I have seen was the work of a species of finch, which stripped the heads of some garden varieties of *Helianthus*. I regret that it is rather too late to collect insects which visit the flowers. Such are very numerous, and, from memory, I should say that our wild and domesticated races of *Apis mellifica* (var. *caffra* and var. *unicolor adansoni*) rank first, while other insects attracted include large numbers of Diptera, mainly Muscids or Syrphids, and smaller numbers of Aculeate Hymenoptera, especially Scoliids and Sphegids. *Chloridea obsoleta* occurred in some numbers at the flowers this season, but otherwise I should say that diurnal Lepidoptera are only casual visitors. Among the Syrphids the most conspicuous visitor is an undetermined species rather similar in appearance to the European *Eristalis tenax*, and of similar habits." (April 6, 1915.)

This account is interesting because, although from a region so remote from the original home of *Helianthus*, it describes a situation singularly like that in other parts of the world where sunflowers are grown. Here in Colorado finches attack the heads, so that we have to bag them in order to save seed. Here at Boulder, *Chloridea* (or *Heliothis*) *obsoleta* Fabr.—the very moth observed in Rhodesia —visits the flowers of annual *Helianthus*, as well as those of the perennial *H. coloradensis* Ckll. In Rhodesia, as in America and Europe, there is the same general absence of butterflies as sunflower visitors. The particular *Plusia* feeding on sunflower in Rhodesia does not occur with us, but J. R. Parker (Journ. Econ. Ent., 1915, p. 288) records that *Plusia* (or *Autographa*) *gamma californica* Speyer feeds on sunflower

Mr. A. W. Hanham (Canad. Entom., 1914, p. 145) has shown that in British Columbia sunflowers are especially visited by species of *Plusia* and related genera. Records from other localities suggest that much the same thing may be observed elsewhere, though no other collector has taken the trouble to make a careful list. At Boulder, Colorado, Sept. 2, 1914, in bright sunshine, I found *Caloplusia ignea* (Grote) visiting the flowers of *Helianthus lenticularis*. Also at Boulder, July 31, I collected *Plusia* (or *Syngrapha*) *falcifera* Kirby (*simplex* Gn.) at flowers of annual garden *Helianthus*. Three specimens were taken.

During the season of 1914, the one really serious pest of our red sunflowers (varieties of *Helianthus annuus*) was the common *Nysius*. These insects assembled in numbers on the flower-stalks, and caused the heads to wilt and die. They seemed to be principally injurious on plants the heads of which had been bagged for cross-pollination, multitudes of them collecting just below the bag, and by their combined attack destroying the head Although this is a very common insect, its name is not settled beyond doubt. Formerly, following Van Duzee and others, it was labelled *N. angustatus;* but according to Horvath this is a synonym of *N. ericæ* Schill. Professor C. P. Gillette writes, however, that the common Colorado species is now to be referred to *N. minutus* Uhler. He even doubts whether true *angustatus* occurs in Colorado. Dr. Van Duzee writes that formerly he considered *minutus* a synonym of *angustatus*, but he now treats it as a distinct variety of *ericæ* or *angustatus*. At La Jolla, California, he finds that all the specimens are *minutus;* but in Kansas and elsewhere in the Mississippi Valley he found *angustatus* the commoner form. It appears, from all this, that we should call our Boulder pest *Nysius ericæ minutus*.

Dr. S. A. Forbes, in Rept. Ill. State Entomologist for 1913 and 1914 (1915), p. 4, refers to the sunflower weevil, "an insect new to agriculture which has led to the virtual abandonment of the growing of sunflower seed for oil." Dr. Forbes does not mention the scientific name of the weevil, but in a letter he kindly informs me that it is *Smicronyx fulvus*. Now, this *S.* (or *Desmoris*) *fulvus* Lec. is very common on the sunflowers at Boulder, but we have not found it a serious pest. There are two Torymine Chalcids,

kindly determined by Mr. J. C. Crawford as *Callimome* sp. and *Zaglyptonotus schwarzi* Cwfd., which we find hovering over and alighting on the sunflower heads, and from their actions it is suspected that they may be parasitic on the weevils. An effort will be made this year to determine whether this is the case, and whether they can be of any use if introduced in Illinois. A third Chalcid common on the sunflower heads is *Perilampus hyalinus* Say.

Some years ago Mr. Busck reported of the Gelechiid *Paltodora similiella* (Chamb.) that he had received specimens in poor condition, but apparently this species, reared from sunflower heads by E. E. Bogue in Oklahoma. At Longmount, Colorado, Aug. 30, 1914, I found a number of small moths at flowers of *Helianthus lenticularis*, and when specimens were sent to Mr. Busck, it turned out that they belonged to this same *P. similiella*, which is doubtless a regular sunflower insect.

A cutworm from a sunflower head, collected at Boulder, Aug. 16, gave a moth Oct. 4. It was the widely distributed *Lycophotia margaritosa* Haw. (*saucia* Hbn.).

In Sept., 1914, at Boulder, a larva of *Phyciodes ismeria* (*carlota* Reak.) was found on *Helianthus argophyllus* in the garden; a new food plant. On the ordinary sunflower young larvæ of *P. ismeria*, about 8 mm. long, were common October 5. Like *Chlosyne lacinia*, this species evidently hibernates as a larva.

The yellow Bombyliid fly, *Phthiria sulphurea* Lw., visits sunflower heads at Boulder in August, but I found that it sometimes got caught by the likewise cryptically coloured bug, *Phymata fasciata*.

NOTES ON SOME RECENTLY DESCRIBED SPECIES OF NORTH AMERICAN LEPIDOPTERA.

BY WM. BARNES, M.D., AND J. MCDUNNOUGH, PH.D., DECATUR, ILL.

In the November number, 1914, of "Insecutor Inscitiæ Menstruus," Dr. Dyar describes eight species of North American Lepidoptera. As far as can be judged from a mere reading of the descriptions, several of these species appear to have already received names, but without an actual knowledge of the type specimens we cannot state authoritatively that such is the case. We therefore

offer the following notes in the hope that those students who have an opportunity to examine the type material may either verify or disprove our statements.

Apantesis moierra Dyar.

This is apparently *quadrinotata* Stkr., a name at present sunk in the synonymy of *placentia* A. & S. Strecker's species, described and figured in the Proc. Dav. Acad. N. Sciences, Vol. II, p. 271, 1878, from several ♀'s from Texas agrees in locality with *moierra* Dyar. *Sociata* B. & McD., described from a single ♀ from New Mexico (1910, Journ. N. Y. Ent. Soc., XVIII, 149), will probably also prove to be a synonym. Until the ♂'s are known, nothing very definite can be said about the species, but we venture the guess that they will prove to have banded primaries and be intermediate between *figurata* Dru. and *placentia* A. & S. .

Schinia navarra Dyar.

The description reads remarkably like that of *cupes* Grt. and the type localities are similar. If it were not for the fact that *cupes* should be correctly identified in the National Museum, and therefore known to Dr. Dyar, we should not hesitate in making the two names synonymous. In his tables Hampson has not been very fortunate in his placing of *cupes*, and this may have misled Dr. Dyar.

Gonocausta sabinalis Dyar.

This is doubtless the species referred to by us (Contrib. II, 224) to *zephyralis* Led. A series will be necessary to prove whether the points of distinction mentioned by Dr. Dyar have specific value or not. Our single specimen lacks the fringes, so is of no value in this connection.

Artopsis nua Dyar.

We fear that the genus *Artopsis* Dyar must fall before *Parachma* Wlk. Hampson (Proc. Lond. Zool. Soc., 1897, p. 659), it is true, figures and defines the genus as having only 11 veins on the primaries, at the same time making *Perseis* Rag. (Ann. Soc. Ent. Fr., 1890, p. 538) a synonym. This latter genus, founded on *culiculalis* Hlst., is distinctly stated, however, to have twelve veins, and later Ragonot himself, after an examination of the British Museum types (Ann. Soc. Ent. Fr., 1892, p. 624) sinks his genus to *Parachma* Wlk.

Our own examination recently of the type of *Parachma ochracealis* Wlk. has confirmed Ragonot's statement and proved Hampson in error. Judging by Dr. Dyar's remarks, we doubt greatly whether he has correctly identified *ochracealis* Wlk., for he refers to it in the present paper for some subtle synonymic reason which we cannot fathom to *Arta* Grt., a genus not erected until 1875 and over which *Parachma*, in any case, would have priority if the two were synonymous, which they are not. We might further point out that *culiculalis* Hlst., at present reposing in the synonymy of *ochracealis* Wlk., was described from Florida as is *nua* Dyar, and it is not at all improbable that these two names refer to one species, which may or may not be distinct from *ochracealis*. A study of the type material will be necessary before any definite statement in this connection can be made.

ENTOMOLOGICAL SOCIETY OF ONTARIO.

The 52nd Annual Meeting of the Society will be held at Ottawa on the 4th and 5th of November. The public lecture will be delivered on the evening of Thursday, the 4th, by Dr. L. O. Howard, Chief of the Bureau of Entomology at Washington. The titles of papers to be presented should be sent as soon as possible to the acting secretary, Mr. Arthur Gibson, Division of Entomology, Department of Agriculture, Ottawa, in order that they may be included in the programme which is shortly to be issued. The length of time required for reading the paper should be mentioned, and also whether the use of a lantern is desired.

The members of the Society will be much gratified to learn that a branch has been formed in Nova Scotia, bearing the name of the Province and with headquarters at Truro. The initial membership is twenty-seven, and there are prospects of a goodly increase when the branch has become fully organized and entered upon active work. This is the first time that one of the Maritime Provinces has become formally connected with our Society, though all along we have had individual members in a few localities by the sea.

Professor Brittain, of the Agricultural College at Truro, N.S., is the acting secretary. A career of great usefulness is open to the branch, and hearty good wishes are extended for its growth and permanent success.

NEW CANADIAN AND ALASKAN MUSCOIDEA.

BY CHARLES H. T. TOWNSEND,
Bureau of Entomology, Washington, D. C.

This paper presents descriptions of some British Columbian forms, received for determination at the Bureau of Entomology, U. S. Department of Agriculture, sent by Mr. F. Kermode, Director of the Provincial Museum at Victoria, B. C. To these are added descriptions of a few new forms, represented by material in the U. S. National Museum collection, from British Columbia, Saskatchewan and Alaska, collected by Messrs. Currie, Cockle, Knab and Kincaid

Family *Callirhoidæ*.

Alaskophyto new genus.

Genotype—*Muscopteryx obscura* Coquillett, 1902, Proc. U. S. Nat. Mus., XXV, 116.—St. Paul Island, Alaska.

May be distinguished from other members of the Phyto group as follows: Male—Vertex and posterior part of front one-ninth or one-tenth of head width. Ocellars rather strong; vibrissæ strong and decussate, curved, single, inserted even with oral margin; second and third antennal joints about equal, arista thickened on basal fourth or less; front but feebly prominent, cheeks over one-half eye-height; facial profile much shorter than frontal; palpi stout-filiform. Long decussate apical pair of scutellars and two laterals. Macrochætæ of abdomen weak, rather thickly placed, interspersed with hair, venter more hairy. Claws elongate. Wings narrow. Apical cell narrowly open or closed, ending slightly before wing-tip; cubitus very broadly open, no stump or wrinkle, apical cross-vein straight. Abdomen same width as thorax, elongate.

Family *Miltogrammidæ*.

Arabiopsis new genus.

Genotype—*Arabiopsis cocklei* Townsend, new species.

Allied to *Euaraba* Townsend, from which it differs chiefly as follows: Head subrectangular in profile, the lower border about three-fourths as long as upper, the epistoma distinctly produced; facial depression shorter, facial profile slightly concave, third antennal joint of male shorter and broader, arista slender on distal third or more; parafacials naked below, with a patch of hairs above

male with row of about six proclinate weak orbital bristles situated well in front outside frontal row, usually two or three more strongly developed than the others. Male front at vertex about equal to one eye, vibrissæ hardly meeting. Macrochætæ of mesoscutum, scutellum and abdomen long, rather thickly and evenly distributed, interspersed with long bristly hairs; apical scutellar pair well-developed and decussate. Abdominal macrochætæ only marginal, two median on first segment, about four median on second segment, practically complete row on third and anal segments, all very closely placed.

Arabiopsis cocklei new species.

Length of body 5 mm.; of wing 4 mm. One male, London Hill Mine, Bear Lake, British Columbia, 7,000 ft., July 21, 1903 (J. W. Cockle).

Blackish, front and face heavily silvered, changing to a leaden shade with incidence of light; frontalia invaded on each side about middle by an irregular patch from parafrontals whose light incidence is contrasted with that of frontalia, whereby the latter alternate with the patches in brilliancy according to the change of light. Mesoscutum thinly silvery on sides and in front, showing four narrow black vittæ, of which the middle ones stop at suture; in very oblique lights the scutellum and disk of mesoscutum are seen to be also covered with a thin coat of silvery pollen, but this is invisible in direct view. Abdomen blackish below and broadly so above, with rather broad silvery margin on sides, leaving a small blackish spot segregated from the median black on hind margin of second and third segments laterally. Legs wholly black, the femora silvery on outer surface. Wings clear; tegulæ whitish, narrowly bordered with pale yellowish. Third antennal joint soft black with a grayish sheen, arista deep black.

Holotype, No. 19554 U.S.N.M.

This species is named in honour of Mr. J. W. Cockle.

Family *Salmaciidæ*.

Knabia new genus.

Genotype—*Knabia hirsuta* Townsend, new species.

Differs from *Salmacia* as follows (male only described): Front at vertex distinctly less than one-half head-width. Frontal

bristles hairlike, in only two rows; parafrontals and parafacials thickly covered with long fine hair. Ocellars and the two proclinate and two reclinate fronto-orbitals rather hairlike, even the inner verticals but slightly stronger and still quite hairlike. Marginal row of bristles on parafacials same strength as frontals. Face conspicuously wider than front. Parafacials fully as wide as cheeks, hardly at all narrowed below, the parafrontals very conspicuously narrower. Proboscis much shorter, the part below geniculation not as long as third antennal joint. Thorax, pleuræ, scutellum, abdomen and femora thickly clothed with fine long hair, all the macrochætæ comparatively weak, Legs more slender. Claws short.

This genus is named in honour of Mr. Frederick Knab.

Knabia hirsuta new species.

Length of body 10.5 to 11 mm.; of wing 8 to 8.5 mm. Two males, Oxbow, Saskatchewan, April 30 and May 13, 1907 (F. Knab).

Black. Head all yellow, pale gold pollinose, satiny; lateral portions of occiput lead-gray. Palpi and second antennal joint rufous, third joint soft gray-black, arista jet-black. Occipital beard pale grayish-golden; cheek, facial, frontal and all the other hair black. Thorax with very faint bloom, four linear brownish or blackish vittæ showing. Scutellum testaceous, broadly black on base. Abdomen rather shining black; segments two to four, narrowly edged on base with silvery-white, broadening on sides of anal segment. Legs black, tibiæ often with a brownish tinge. Wings clear except the smoky oblique basocostal area. Tegulæ nearly white, margined with pale tawny.

Holotype, No. 19555 U.S.N.M.

Family *Minthoidæ*.

Pseudodidyma new genus.

Genotype—*Pseudodidyma pullula* Townsend, new species.

Differs from Wulp's description of *Didyma* as follows: Head subquadrilateral, but profile much narrowed below, the face very receding. Front prominent, much wider than one eye, about same in both sexes. Facialia not ciliate, with only a few bristles that reach hardly over one-fourth way up. Facial depression

broad, facialia flared outward, a weak median carina present. Parafacials more on edge in male than in female. Second antennal joint short in both sexes; third joint of male well broadened and about six times second in length, that of female no broader than distal end of second and not over four times length of second. Arista thickened on basal three-fifths Male without proclinate fronto-orbitals, but with three reclinate ones in triangle, of which the outer one corresponds to a proclinate one in female. Female with two proclinate and two reclinate. Both sexes with the frontal row doubled anteriorly, the outer row weak. Frontals descending quite to insertion of arista. Frontalia occupying fully one-third of frontal width in female, broad throughout; those of male narrowed anteriorly. Cheeks about one-half eye-height in both sexes. Epistoma cut off, vibrissæ practically on oral margin. Eyes quite thickly hairy in both sexes. Antennæ as long as face. Proboscis very short and fleshy, palpi slightly thickened apically. Scutellum without apical decussate pair of bristles; with three laterals, of which the posterior is longest; and a closely-approximated discal pair. Abdomen ovate in both sexes; macrochætæ marginal and discal, including median marginal pair on first segment. Claws of male quite elongate, about as long as last tarsal joint; those of female a little shorter. Hind cross-vein much nearer to cubitus than to small cross-vein Belongs in the *Admontia* group. May be distinguished from *Admontia* by the bare parafacials and short second aristal joint.

Pseudodidyma pullula new species.

Length of body 5.25 mm.; of wing 5 mm. One female, Farragut Bay, Alaska, June 1, 1899 (T. Kincaid). This is the specimen determined by Coquillett as *Didyma pullula* Wulp, Dipt. Harriman Alaska Exped., 438 (sep. pag. 52).

Blackish, cinereous pollinose. Whole face and anterior edge of parafrontals silvery-ashy, cheeks somewhat less so. Palpi fulvous. Frontalia brown. Antennæ blackish or brownish. Parafrontals blackish, thinly pollinose; thorax and scutellum same. Four vittæ on mesoscutum, middle ones narrow, outer ones heavier and broken. Abdomen blackish, not shining, with a submarmorate ashy-pollinose effect, the pollen for most part of same

obscure shade as that of thorax and front, but with a silvery shade in some lights; the pollen best defined on narrow base of second segment, basal half of third, and all of anal segment. Legs brownish, tibiæ rufous. Wings distinctly smoky-yellow along the veins. Tegulæ smoky-yellowish, front scale slightly more whitish.

Holotype, No. 19556 U.S.N.M.

A male from Victoria, British Columbia, April 2, 1906 (E. M. Anderson, through F. Kermode), measures 6 mm., wing 5.5 mm., and differs in wings being clear, tegulæ watery-whitish, pollen of base of second abdominal segment broadening on sides, tibiæ only narrowly rufous on middle, and antennæ wholly deep black. It may be a distinct species, but seems congeneric with the above female.

Family *Larvævoridæ*.

Okanagania new genus.

Genotype—*Okanagania hirta* Townsend, new species.

Differs from *Ostracophyto* as follows: Male.—Facial profile deeply bent in, the epistoma very prominent. Facialia with thick bunch of bristles just above vibrissæ, but otherwise bare. Eyes thickly clothed with long hair. Parafacials bare, wide. Front at vertex a little narrower than eye, much narrowed in middle, widening still more anteriorly than at vertex, very prominent in profile. Parafrontals broad anteriorly, with bristly hairs outside the frontal row and long hair on vertical and ocellar regions. Occipito-orbital fringe very long, decreasing in length gradually from the outer verticals. Vibrissæ inserted well above oral margin, widely separated. Second antennal joint long; third broad, not twice as long as second. Arista thickened on more than basal half, first joint short, second joint elongate. Long apical decussate pair of macrochætæ on scutellum; discal pair of straight bristles, with several others approximating them in strength. Median marginal and discal macrochætæ on second and third segments, median and lateral discal on fourth with marginal row, fourth and fifth rather thickly covered with long hair besides the bristles. Thorax, pleuræ, scutellum, venter and legs also with long hair and bristles. Claws elongate, about as long as last tarsal joint. Hypopygium large. Apical cell narrowed at extremity, narrowly open, ending

far before wing-tip. Hind cross-vein nearly straight, close to the right-angled cubitus. Apical cross-vein quite evenly concave outwardly. Cubitus with slight wrinkle. Costal spine small. Wings broad; third vein bristled only at base, others bare.

Okanagania hirta new species.

Length of body 9.5 mm.; of wing 7.5 mm. One male, Okanagan Falls, British Columbia, April 27, 1913 (E. M. Anderson, through F. Kermode, No. 190).

Black. Head silvery-cinereous, epistoma and vertex with darker shade. Occipital beard brassy-gray, all other hair black. Thorax with submetallic shining greenish shade. Scutellum broadly testaceous on apex. Abdomen blackish, subshining; with a small rufous spot on each side of second segment near lateral margin, and a faint suggestion of same on third segment. Wings nearly clear. Tegulæ whitish.

Holotype, No. 19557 U.S.N.M.

Panzeriopsis new genus.

Genotype—*Panzeriopsis curriei* Townsend, new species.

Differs from *Ernestia* as follows: Male. Front at vertex much wider than eye. Epistoma very prominent, subhorizontally projected. First and second aristal joints both elongate, the first longer than second. Third antennal joint same length as the elongate second, widened, rounded apically. Parafacials with long hair, same as front and cheeks. No ocellar bristles. Eyes bare. Three to six facio-orbitals. Proboscis much longer than head-height, moderately slender. Palpi elongate, slender, a little widened apically but thin. Cheeks only a little less than eye-height. Mesoscutum devoid of macrochætæ except on lateral margins and a weak pair or two on hind margin, the surface being clothed with long hair. Scutellum with a decussate apical pair of bristles, three fairly strong laterals, some weaker laterals and hairs, and some discals and hair. Abdomen with two to four discals on second and third segments, two to four median marginal on second, third with marginal row, fourth with marginal row and more or less complete discal row. Apical cell ending farther

before wing-tip, the cubitus more removed from hind margin of wing.

Panzeriopsis curriei new species.

Length of body 10.5 to 11.5 mm.; of wing 9 to 9.5 mm. Four males, London Hill Mine, Bear Lake, British Columbia, 7,000 feet, July 21 to 29, 1903 (R. P. Currie).

Black. Clypeus and parafacials silvery pollinose, shading to dark in oblique lights. Parafrontals polished black. Epistoma and cheeks subshining black, former slightly pollinose. Frontalia light brown. Palpi pale rufous to rufous. Beard brassy-gray. Thorax without pollen or vittæ, subshining, with slight metallic greenish lustre. Scutellum rufotestaceous on apex or almost wholly so. Abdomen subshining black, without pollen, usually obscure dull rufotestaceous on sides of second and third segments or on sides of second segment alone. There is some suggestion of metallic green on abdomen, especially on anal segment. Legs and antennæ black. Wings clear, base pale flavous, veins fulvous. Tegulæ watery-whitish, with pale yellowish margins.

Holotype, No. 19558 U.S.N.M. July 21.

Named in honour of Mr. R. P. Currie.

Rhachogaster new genus.

Genotype—*Rhachogaster kermodei* Townsend, new species.

Differs from *Upodemocera* as follows: Male.—Front narrowed at vertex to little over one-half eye-width. Third antennal joint normal, rounded apically. First aristal joint short. Lobular edges of second genital segment set with short toothlike spines. Second ventral plate with thick bunch of short sharp needle-point spines directed backward. Third ventral plate with some very short inconspicuous spines; fourth with a few short hairs; fifth with some long hairs. Ventral profile deeply cut out when hypopygium is exserted.

Rhachogaster kermodei new species.

Length of body 13 mm.; of wing 10 mm. Two males, Penticton, British Columbia, July 4 and 8, 1913 (E. M. Anderson, through F. Kermode, Nos. 187, 188).

Black. Face and cheeks pale golden pollinose. Parafrontals silvery-white pollinose. First two antennal joints and palpi rufous; frontalia brownish-rufous, with silvery bloom. Beard brassy. Thorax metallic greenish; scutellum testaceous. Abdomen black, shining. Wings clear, bases pale yellow. Tegulæ tawny-white to whitish.

Holotype, No. 19559 U.S.N.M.

Named in honour of Mr. F. Kermode.

ORGANIZATION OF AN ENTOMOLOGICAL SOCIETY FOR NOVA SCOTIA.

At a meeting held at Truro on Aug. 3rd a Nova Scotia branch of the Ontario Entomological Society was successfully formed. This meeting was held in the Assembly Hall of the Normal College, and was largely attended by members of the staff of the Normal and Agricultural Colleges, by students of the Rural Science School, by members of the Provincial and of the Dominion Entomological Branch and others.

Both an afternoon and evening session were held, at which various interesting and instructive papers on various phases of entomology were read and discussed. Following the reading of the papers, the aims and purposes of the Society were explained by Mr. W. H. Brittain, Provincial Entomologist, whereupon the meeting proceeded to the election of the following officers for the ensuing year:

Hon. President—Dr. A. H. MacKay, Supt. of Education, Halifax.

President—E. Chesley Allan, Yarmouth.

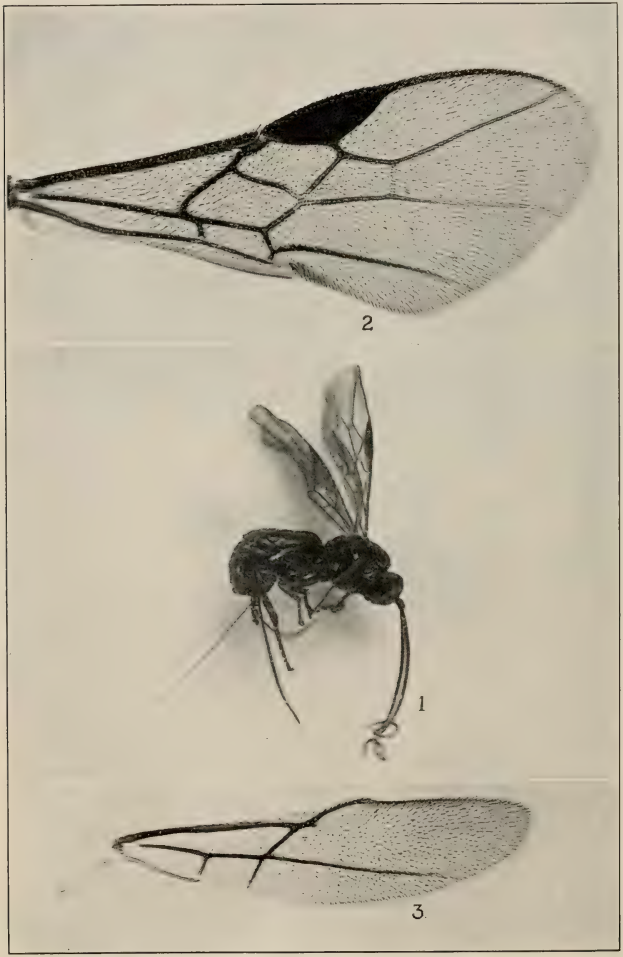
Vice-President—L. A. DeWolfe, Truro.

Secretary-Treasurer—W. H Brittain, Truro.

Assistant Secretary-Treasurer—G. E. Sanders, Bridgetown.

Committeemen—C. A. Good, Truro; J. M. Scott, Truro.

At the close of the evening session 27 individuals signed the roll of the Society and handed in their annual subscription, while a number of others signified their intention of becoming members. With this auspicious beginning it is hoped that the Nova Scotia Entomological Society will continue to increase in members and influence and remain a live organization in the Province for many years to come.



BIOSTERES RHAGOLETIS, N.SP.

BIOSTERES RHAGOLETIS RICHMOND, SP.N., A PARASITE OF *RHAGOLETIS POMONELLA* WALSH.*

BY WILLIAM COLCORD WOODS, ORONO, MAINE.

During the summer of 1913 the writer was engaged in studying blueberry insects in Washington County, Maine. A maggot was found infesting the berries, which when bred proved to be *Rhagoletis pomonella* Walsh, the apple maggot or railroad worm (Journal of Economic Entomology, 1914, Vol. VII, pp. 398-399). There were also obtained from larvæ of this species collected at Cherryfield, Maine, in August and September, 1913, twenty-one specimens of a parasite, which emerged from puparia kept under laboratory conditions, at various dates between February 25 and April 21, 1914.

Since no parasite has been recorded from *Rhagoletis pomonella* Walsh, this note accompanied by the plate should be of interest. The figures represent, enlarged, an adult, and the fore and hind wings.

This species belongs to the family *Braconidæ* and to the subfamily *Opiinæ*. In this same group are placed many of the parasites, including one of this genus, which are recorded by Silvestri as bred from various fruit-flies (Bulletin 3, Hawaii Board of Agriculture and Forestry, 1914).

Specimens of this species were swept on the blueberry barrens of Washington County last summer, where apparently they had considerably reduced the number of the maggots as compared with the preceding season. Unfortunately all the puparia which I collected during the summer of 1914 were destroyed so that neither parasites nor flies emerged, but I hope to make further collections this present year. I have not observed oviposition, but this species is undoubtedly a larval parasite, although the adults do not emerge until after the puparia have been formed.

Dr. H. H. P. Severin has this year bred the same species from puparia of *Rhagoletis pomonella* Walsh, obtained either from the

*Papers from the Maine Agricultural Experiment Station. Entomology No. 80.

wild crab or cultivated apples in Orono, Maine, while engaged in special work for this Station.

Specimens of the Cherryfield parasites were submitted to Mr. E. A. Richmond, of Cornell University, who determined it as a new species. The following description, which he has given me permission to publish, should be credited to him, as well as the synonymy of the genus, which follows:

Biosteres rhagoletis, sp.n. (Plate XII.)

"Fulvous (xanthine orange); antennæ, except scape in ♂ (partly in ♀), terminal joints of pro- and mesothoracic tarsi, entire metathoracic tarsi and tips of mandibles, brown; eyes and ocelli black; wings with membrane colourless, nervures and stigma brown; sheath of ovipositor brown; inner stylets fulvous. Length 3 mm.; ovipositor 3 mm. Habitat—Cherryfield, Maine.

"*Head* shining, closely tessellate, punctulate, pilose (including mouth-parts); ocellar elevation impunctate and not pilose; face with a median longitudinal elevation, almost a keel: *clypeus* with sparser punctures in centre; *flagellum* 36–41-jointed; scape a little longer than first joint of flagellum, pedicellum globular. *Thorax* shining, sparsely punctulate and pilose; parapsidal furrows converging and ending in a median V-shaped, impunctate impression, which lies in the posterior third of the mesonotum; mesonotum (including scutellum) margined; propodeum not flat but rounded, more pilose and punctulate than the rest of thorax, irregularly rugulose and tending to have poorly-defined areoles, which are more especially prominent in ♀ ♀; r (first abscissa of the radius), a little more than 1/6 as long as r-m; shorter than the petiole of M_4; M_4 petiolate, petiole about 1/5 as long as m-cu. *Abdomen* finely punctulate, shining, very sparsely pilose; 1st segment margined laterally, finely and closely striated with some of the elevations often more prominent at basal half; 2nd segment with a little more than its basal half finely and closely striated, except at sides; ♂ and ♀ similar, except as noted above.

"Cotypes deposited in collections of the Maine Agricultural Experimental Station, Orono, Maine; Cornell University, Ithaca, N. Y., and in the private collection of E. A. Richmond, Ithaca,

N. Y. Paratypes deposited in the collections of the Maine Agricultural Experiment Station, Orono, Maine; the United States National Museum, Washington, D. C., and in the private collection of W. C. Woods, Orono, Maine. Type locality, Washington County, Maine.

"Described from 10 specimens, 7 ♀ ♀ and 3 ♂ ♂. Bred from puparia of *Rhagoletis pomonella* Walsh from blueberries, by W. C. Woods, Maine Agricultural Experiment Station; lot 1,700, sub. 17."

Genus *Biosteres* Förster.

1862. *Chilotrichia* Förster, Verh. Nat. Ver. Preuss. Rheinl., v. 19:258.

Biosteres Förster, Verh. Nat. Ver. Preuss. Rheinl., v. 19:259.

Rhabdospilus Förster, Verh. Nat. Ver. Preuss. Rheinl., v. 19:259.

1895. *Trichopius* Thompson, Op. Ent., p. 2,176.

1904. *Biosteres* Szepligeti, Gen. Ins., Fasc. 22, p. 161.

The following description is a translation of the distinguishing characters of the genus *Biosteres* Förster, as stated in the Genera Insectorum, fascicle 22, p. 161.

"Clypeus bare or strongly and thickly pilose (*Chilostrichia* = *Trichopius*), forming no opening with the mandibles (except *Rhabdospilus*). Stigma small and long, the inner side shorter or almost as long as the outer. Second submarginal cell shorter than in *Opius*. Second abscissa of radial vein as long or barely longer than the r-m. Parapsides usually distinct, mesopleura with or without furrows."

Mr. Richmond informs me that *B. indotatus* Viereck (described from Kansas in the Trans. Kans. acad. sci., 1905, v. 19: 272-278), which is black in colour, is the only other species of *Biosteres* described from Region 5.

Explanation of Plate XII.

Fig. 1. *Biosteres rhagoletis*, n.sp., female; fig. 2, fore wing of same; fig. 3, hind wing of same.

A CONTRIBUTION TOWARDS THE TAXONOMY OF THE *DELPHACIDÆ*.

BY F. MUIR,
Hawaiian Sugar Planters' Experiment Station, Honolulu, T.H.

[Continued from Page 270]

DELPHACINI.

1 (6) Mesonotum with five carinæ.

2 (3) Two medio-longitudinal frontal carinæ, meeting together at base and apex { *Micromasoria.* / *Livatis**.

3 (2) One medio-longitudinal frontal carina.

4 (5) In profile head semicircular; antennæ terete..... *Paranda.*

5 (4) In profile head not semicircular; first joint of antennæ compressed and dilated, obliquely triangular, second slightly longer than first..... *Eodelphax.*

6 (1) Mesonotum with three carinæ or less.

7 (20) Antennæ with one or both segments distinctly flattened.

8 (9) Two medio-longitudinal frontal carinæ, distinct throughout or approximate at one or both ends.. *Pseudaræopus.*

9 (8) One medio-longitudinal frontal carina, simple or furcate.

10 (13) First antennal joint long, subparallel sided, semifoliaceous, antennæ as long as face and clypeus together.

11 (12) Head as wide, or nearly as wide, as pronotum.... *Delphax.*

12 (11) Head narrower than pronotum..... *Sparnia.*

13 (10) First joint of antennæ subtriangular or sagittate, antennæ not as long as face and clypeus together.

14 (15) Length of face equal to width between eyes; clypeus angled in middle, the median carina forming deep keel at bend..... *Bostæra.*

15 (14) Length of face considerably greater than width.

16 (17) First joint of antennæ sagittate, antennæ not as long as face; medio-longitudinal carina of face furcate at extreme base; sides of face slightly arcuate; clypeus bent nearly at right angle in middle..... *Belocera.*

17 (16) First joint of antennæ triangular, but not sagittate; clypeus not angular in middle.

*I can find no distinctions between these two genera from the descriptions.

18 (19) Medio-longitudinal carina of face furcate near lower margin of eyes, base of face narrower than apex, lateral margins slightly arcuate; lateral carinæ of pronotum divergingly curved posteriorly, not reaching hind margin ..... *Perkinsiella.*

19 (18) Medio-longitudinal carina of face furcate at extreme base, lateral margins subparallel, lateral pronotal carinæ at first sharply diverging, then converging, reaching hind margin (in some species the posterior portion from bend is obsolete)..... *Stobæra.*

20 (7) Antennæ terete or but very little flattened.

21 (24) Face and notum with numerous "pits."

22 (23) Face with two medio-longitudinal carinæ..... *Achortile.*

23 (22) Face with one medio-longitudinal carina..... *Laccocera.*

24 (21) Face and notum without "pits."

25 (26) Anterior and intermediate femora and tibiæ compressed and foliaceous { *Phyllodinus**. *Platybrachus.*

26 (25) Legs simple, not foliaceous.

27 (30) Only one carina (median) on pronotum (all carinæ on head very faint; one medio-longitudinal carina on face).

28 (29) Antennæ very short, first joint not longer than second ..... *Upachara.*

29 (28) Antennæ long, first joint much longer than second ..... *Hapalomelus.*

30 (27) Two or three carinæ on pronotum.

31 (32) Lateral edges of pronotum carinate; **a single medio-longitudinal carina on vertex † ..... *Pundaluoya.*

32 (31) Lateral edges of pronotum not carinate.

33 (34) Vertex with a transverse ridge between eyes..... *Toya.*

34 (33) Vertex without a transverse ridge between eyes.

35 (40) Carinæ of head very indistinct, vertex little broader than long.

*Some species of *Phyllodinus* have obscure pits and some *Achortile* have slightly flattened legs, but in species I am acquainted with the latter has an angular emarginated posterior margin to the pronotum and in the former it is not angularly emarginated.

**According to Distant's figure and description.

†According to Melichar's figure.

36 (37) Antennæ long, reaching nearly to end of clypeus, first joint distinctly more than half the length of second; spur with a few distinct teeth on hind margin ..... *Kormus.*

37 (36) Antennæ not so long, reaching about end of face, second joint about double as long as first.

38 (39) First joint of hind tarsus longer than the other two together, spur with many fine teeth on hind margin ..... *Anectopia.*

39 (38) First joint of hind tarsus not so long as the other two together, spur with minute tooth at apex, but none on hind margin, or very minute hair-like ones ..... *Eurysa.*

40 (35) Carinæ of head distinct.

41 (52) Face with two medio-longitudinal carinæ.

42 (45) Vertex distinctly broader than long.

43 (44) Face angular, as wide as long..... *Amblycotis.*

44 (43) Face longer than wide; carinæ on face indistinct, especially at base and over vertex..... *Eurybregma.*

45 (42) Vertex much narrower in proportion to length.

46 (49) Apex of vertex subangular, making vertex somewhat 5-sided or apex broadly conical.

47 (48) Face broad, about as broad as long, medio-longitudinal carinæ very faint, especially at base, dividing face into three subequal parts..... *Metropis.*

48 (47) Face much narrower, decidedly longer than broad; median carinæ not so faint, contiguous or very approximate at base and apex; median portion of face narrower than lateral portions..... *Jessidæus.*

49 (46) Apex of vertex truncate or but little rounded, vertex square or little longer than wide, not 5-sided.

50 (51) Lateral carinæ of pronotum divergingly curved, not reaching hind margin..... *Criomorphus.*

51 (50) Lateral carinæ of pronotum straight, reaching hind margin ..... *Macrotomello.*

52 (41) Face with one medio-longitudinal carina, simple or furcate.

53 (54) Medio-longitudinal carina of vertex with small areolet in middle; no transverse or medio-lateral carinæ ..... *Liburniella.*

54 (53) Medio-longitudinal carinæ without small areolet, transverse or medio-lateral carinæ present.

55 (74) Medio-lateral carinæ of vertex converging apically, but not meeting on vertex, continued separate on to face, where they meet (frontal carina furcate).

56 (63) Lateral carinæ of pronotum straight or convergingly curved posteriorly, reaching hind margin, or all but doing so.

57 (58) First joint of antennæ more than half the length of second ..... *Megamelus.*

58 (57) First joint of antennæ less than half the length of second.

59 (60) Head and thorax (to end of mesonotum) twice or more the width of head, including eyes; length of face three times the breadth; spur with many (about 12-15) small teeth ..... *Stenocranus.*

60 (59) Less slender forms. Head and thorax about one and a half times the width of head, including eyes; length of face 2 or 2½ times the breadth.

61 (62) Vertex perceptibly longer than broad, apex narrower than base; spur with few (about 8) large teeth.....*Kelsia.*

62 (61) Vertex square; spur with numerous minute teeth ..... *Peregrinus.*

63 (56) Lateral keels of pronotum divergingly curved posteriorly, not reaching hind margin.

64 (65) Medio-lateral carinæ of vertex not meeting lateral carinæ till base, forming two 4-sided areas; face considerably broadened in middle, furcation of median frontal carina very near base.....*Conomelus.*

65 (64) Medio-lateral carinæ of vertex meeting lateral carinæ before base, forming two 5-sided areas; face not so broad in middle.

66 (69) Vertex longer than broad.

67 (68) Vertex double the length of pro- and mesonotum together ..... *Embolophora*[1]

68 (67) Vertex only slightly longer than wide[2].....*Euidella*.

69 (66) Vertex not longer than wide.

70 (71) Face almost circular ..... *Bakerella*[3]

71 (70) Face with sides nearly straight, subparallel.

72 (73) Median frontal carinæ forked near base.....*Liburnia*.

73 (72) Median frontal carinæ forked near middle ..... *Dicranotropis*.

a Median frontal carinæ forked near apex.....*Leimonodite*.

74 (55) Medio-lateral carinæ of vertex meeting together on vertex (meeting sometimes obscure) continued on to face as single carina.

75 (92) Lateral pronotal carinæ straight or convergingly curved posteriorly, reaching hind margin or exceeding near it.

76 (77) Medio-lateral carinæ of vertex meeting together some distance before apex, vertex long and narrow, produced well beyond eyes, slightly narrowed in middle; Y-shaped carina obsolete.....*Saccharosydne*.

77 (76) Medio-lateral carinæ of vertex meeting at apex.

78 (79) Head, including eyes, distinctly wider than pronotum, hind edge of eyes nearly reaching to posterior angle of pronotum; vertex apically truncate, produced but slightly beyond eyes .....*Smicrotodelphax*.

79 (78) Head, including eyes, not wider than pronotum; hind edges of eyes not reaching near to posterior angle of pronotum.

80 (81) Head in profile semicircular.....*Prokelisia*.

1. I place this genus here on the strength of Stal having separated it from *Liburnia* by the length of head.

2. I have not seen *Euidella Speciosa* or *Diacranatropis hamata* so I must let them stand as above for the present. *Nilaparvarta* may come next to *Euidella*.

3. It is possible that this genus will be more appropriately placed in Section B.

81 (80) Head in profile more or less angular at apex of vertex, face flattened.

82 (83) Vertex twice as long as wide ..... *Zuleika*.

83 (82) Vertex considerably less than twice the width.

84 (87) First joint of antennæ more than half the length of second.

85 (86) Broad forms. In dorsal view width of head (including eyes) nearly twice the length; pronotal carinæ in some species not quite reaching hind margin, but not divergingly curved ..... *Pissonotus*.

86 (85) More slender forms. In dorsal view width of head (including eyes) less than 1½ times the length; pronotal lateral carinæ reaching hind margin. } *Megamelus* *Gelastodelphax*

87 (84) First joint of antennæ less than half the length of second.

88 (89) Head and thorax (to end of mesonotum) twice or more the width of head, including eyes ..... *Stenocranus*.

89 (88) Less slender forms. Head and thorax about 1½ times the width of head, including eyes.

90 (91) Lateral margins of face straight, face broadest at apex, base truncate ..... *Sogata*.

91 (90) Sides of face slightly arcuate, apex narrower than middle, base curved or subconical.

a Junction of vertex and face angular in profile, a faint carina dividing them ..... *Haplodelphax*.

b Junction of vertex and face more rounded in profile ..... *Kelisia**

92 (75) Lateral carinæ of pronotum divergingly curved posteriorly, not reaching hind margin.

93 (94) Medio-lateral carinæ of vertex meeting together before apex, vertex well produced beyond eyes (Y-shaped carina faint) ..... *Sardia*.

Conomelus and *Eurysa* can be distinguished from this genus by the broader vertices if the furcation of the frontal carinæ are obscure. *Megamelanus* appears to be near this genus.

94 (93) Medio-lateral carinæ of vertex meeting at apex.

95 (96) Apical margin of vertex conically or roundly produced; face distinctly longer than wide ..... *Delphacinus*†

96 (95) Apical margin of vertex not conically or roundly produced, but truncate or slightly curved.

97 (100) Vertex distinctly longer than wide, apex narrower than base.

98 (99) First joint of hind tarsus distinctly longer than the other two together; antennæ reaching beyond apex of face ..... *Chloriona.*

99 (98) First joint of hind tarsus hardly as long as the other two together; antennæ not reaching to apex of face ..... *Chlorionidea.*

100 (97) Vertex not, or slightly, longer than broad.

101 (102) Face nearly as broad as long..... *Eoeurysa**

102 (101) Face much longer than broad..... *Kalpa*
103 (104) Face very long and slender..... *Nilaparvata* **

104 (103) Face longer than broad, but not greatly so.

105 (106) Face with lateral edges nearly parallel (first segment of antennæ nearly as long as second; two basal areas of vertex 5-sided; two median sectors, first touching cubitus for short distance, characters not strictly reliable ..... *Liburnia.*

106 (105) Face with lateral edges more arcuate (first segment of antennæ much shorter than second; two basal areas of vertex 4-sided; one median sector which amalgamates with first cubitus to apex or near apex) ..... *Conomelus*

†Megamelanus is separated from this genus chiefly by the straight lateral pronotal carinæ reaching the hind margin.

*This may prove to be *Eumetopina.*

**In the Fauna of India *Nilaparvata* is separated from *Kalpa* by furcation of median frontal carina at base, but in the description of the genus the medio-lateral carinæ of vertex are described as meeting before apex.

(To be continued.)

THE 1914 RECORD OF CATOCALÆ AND OTHER LEPIDOPTERA.

BY R. R. ROWLEY AND L. BERRY, LOUISIANA, MO.

This record has to do with Missouri and contiguous territory only and is mainly the story of the best Catocala year since 1900.

The season was not unlike that of 1913, being very hot and dry, and both were duplicates of 1900 and 1901. The winter of 1913-14 was mild up to Christmas, dandelions blooming along the streets of Louisiana to the 23rd of December.

On the 28th of November, the day after Thanksgiving, the senior author collected from black mustard seven larvæ of *Pieris rapæ*, one third of an inch long, securing the first pupa on the 30th of the same month, and the first imago on the 15th of December. This imago was fed on sweet liquids and lived ten days.

Chrysalids of *Smerinthus ophthalmicus*, from larvæ fed the summer before, began giving moths April 18th and up to May 23rd, but only two perfect females out of sixteen were secured. Most of the seven males were perfect. A fine male of this moth that came from the chrysalis at 6 p.m. on the 3rd of May remained motionless, in a box, till 2.30 the next morning, when it began a noisy fluttering. An imago of *Papilio philenor* came from a chrysalis on the 21st of April.

Eggs of *Catocala cerogama* began hatching April 26th, those of *C. coccinata* on the 29th, and of *C. lacrymosa* on the 8th of May. A pair of *Samia columbia* moths from cocoons, furnished the senior author by Mrs. DeCoster of Buckfield, Maine, emerged April 27th.

Ten half-grown larvæ of *Catocala illecta* were collected from honey locust sprouts, April 29th, others on the 1st and 3rd of May.

The first *Samia gloveri*, a fine female, May 1st came from a cocoon furnished by the junior author, but collected by Tom Spaulding of Utah.

The first larva of *Catocala innubens* was found on the 3rd of May, and the first *illecta* began spinning on the 6th of the same month.

Eggs of several species of hickory-feeding Catocalæ began hatching May 5th.

A *Papilio troilus*, ex-pupa, on the same date.

Eggs of *Catocala lacrymosa* began hatching on the 8th of May.

The first luna from cocoon, on the 11th of May, and the first larva of *Catocala innubens* began spinning on the 17th.

A chrysalis of *Ceratomia amyntor* gave an imago on May 18th. Imagos of the larger silk moths usually emerge from the chrysalis in the forenoon, but occasionally later in the day, even to 9 p.m., while the hawk moths and ceratocampians generally emerge in the night time, probably toward morning, the Catocalæ making the change before midnight.

The first larva of *Catocala minuta* was found on honey locust May 21st. A pupa of *Smerinthus excæcatus* gave a moth on the following day.

Half-grown larvæ of *Catocala neogama* were found on walnut on the 26th of May.

The heat of the last week of May killed most of the larvæ of *cerogama*, as well as the hickory-feeding Catocalae.

The first *illecta* imagos emerged June 6th, and the first promethea moths on the same date.

On June 6th the senior author received larvæ and pupæ of Texas hawk moths and chrysalids of butterflies from Miss Pattie Hutchinson of Beeville, Texas, but for lack of suitable food the hawk larvæ died.

The pupa period of *Catocala illecta* is one month.

The first trip to the woods in search of Catocalæ was on the 9th of June, when the senior author took a deformed *polygama* and two fine *iliæ*, one of which was the white spotted variety.

On the evening of the 10th of June Miss Gertrude Wallace took *Catocala whitneyi* at bait. This was the first specimen of this species ever taken here.

Fresh specimens of *Apatura celtis* and *Callidryas eubule* were taken on the 10th.

The second trip to the woods was made on the 11th, and specimens of *Catocala ilia*, *polygama*, *epione*, and one *clintoni* were taken.

A pupa of *Catocala minuta* that as a larva spun on May 27th gave an imago on June 12th.

On June 11th, while wading through underbrush on a heavily wooded hillside, in search of Catocalæ, the senior author came upon a great spider web that held entangled twenty-eight struggling specimens of *Thecla calanus*.

On the 13th of June "Catacala hollow," as well as the hillside, was full of "Catos," *polygama, clintoni, minuta,* and many *ilia.* Took also *Vanessa antiopa, Pyrameis huntera, Euptoieta claudia* and *Feniseca tarquinius.*

Catocalæ were numerous on the 14th, but fewer on the 15th, due perhaps to the cloudy, cool character of the day. What few moths observed were high on the trees, while on the 7th, 11th and 13th, warm dry days, the "Catos" were abundant and at the very bottoms of the tree trunks.

The first bred imago of *Catocala coccinata* emerged on the 17th; a *minuta* on the 18th, and an *innubens* on the 19th.

In the woods on the afternoon of June 19th, found "Catos," very abundant and low on the trees. The day was warm. Both *ilia* and *epione* were by the hundreds, but wary. Individuals of the latter species were on both the tree trunks and in the brush, flying up at every step, and often as many as four or five would fly off of one tree. *Ilia* was hardly less numerous. *Polygama* was fairly common. On this trip the first *grynea*, as well as the first *innubens*, were taken. *Minuta* and *clintoni* were ragged.

Saw the first of the metallic black and green dragonflies (*Calopteryx*) along the Creek Bank on June 15th, and heard the first green cicada on the 16th.

Great numbers of *Argynnis cybele,* with an occasional *idalia,* were taken at Asclepias blooms during the third week of June. At the same time hundreds of individuals of *Pieris protodice* flitted about the fields; in fact, in greater numbers than the senior author ever saw before. Coliads were very few.

June 21st was a banner day. Took *Catocala amica, scintillans, ultronia, neogama, palæogama,* and two fine *dejecta.* The woods were full of moths, low on the trees, but very wary. Both the hollows and hillsides furnished good collecting. The day was hot and dry and the thermometer at 102°.

The next day, June 22nd, was hot and cloudy, and moths were again abundant, especially *amica, polygama, ultronia* and *innubens,* mostly along the branch beds. Saw a few *scintillans* and took a fine specimen with a white discal spot and a splendid female *dejecta.*

On the 23rd, after a slight rainfall of the night before, but still sultry, moths were not scarce, but hardly so plentiful as the day

before. Miss Gertrude Wallace was with the collecting party on this trip and took some good "Catos."

On June 25th saw the first *Catocala junctura* of the season, a beautiful new specimen.

On the night of the 25th took at bait in my own yard specimens of *Catacola epione, illecta, ultronia, amica, innubens,* and *grynea.*

On the forenoon of the 26th found the woods full of moths, 25 to 30 often flying from one tree trunk, but mostly *epione* and *innubens.* Took two fine *neogama*, three fine *palæogama*, the first *residua* of the season and five *Catocala serena*, the first senior author ever saw in Missouri. These last were taken on elm, hickory and oak, and when disturbed flew around the tree and alighted a little "higher up," like *amica*, *habilis* and other small species. *Catocala* of several species were not uncommon on the shade trees along the streets at Louisiana.

Another good day was the 28th, when the senior author, in company with Frank Caldwell and Lowell Pinkerton, took good specimens of *neogama, palæogama, residua, epione, innubens, scintillans, amica, ilia* and one *junctura*, a splendid specimen. The day was somewhat cooler and the moths correspondingly fewer than on the 26th. The best catch was, perhaps, a fine male *subnata*, a rare moth here.

At "Bouncing Bet" flowers, on the same day, took numbers of *Deilephila lineata* of the largest size, and on the 29th took a good specimen of *Hemisesia titan* on the same flowers.

In the woods on the 1st of July, after a steady all-night rain, found no moths on the hillsides, but a few *innubens* and *scintillans* about tree roots in the hollows. Took a perfectly fresh specimen of *Ceratomia amyntor* of as large size as the species attains. The day was cloudy, damp and threatening rain.

July 4th was a hot, damp day and "Catos" were plentiful at the bases of the trees. We took *flebilis, retecta, cara, palæogama, neogama, residua,* and *phalanga.* Of these *flebilis, retecta, cara* and *phalanga* were the first of the season. Miss Wallace and John DeGroodt accompanied the senior author on this trip.

On the 5th found moths abundant and low on the trees. Weather hot and somewhat damp. Took fine specimens of *cara, residua, obscura, subnata, palæogama, neogama* and *phalanga.* Other species were poor.

The 6th was hot and close and the Catocalæ were abundant on the hillside facing the east and in the branch bed, but were few higher on the hill. The flight of scores of *innubens* and *palæogama*, disturbed by the collector's approach, scared other and better things away. Took a splendid female *subnata* near the head of the hollow, and on the hillside, took the first *viduata* of the season, a male *dejecta* and other good moths. *Residua* were abundant, and *cara* and battered specimens of *ilia* common.

On the afternoon of the 8th found "Catos," especially *palæogama*, *innubens*, and *residua* very abundant and *neogama* fairly common. Among other things, took a fine female *subnata* and a ragged female *isolabilis*. The day was close and hot.

July 12th was a red-letter day in moth collecting. Weather intensely hot and dry. Took the first *nebulosa*, *habilis* and *lacrymosa* of the season. The last named, a variety of singular beauty with both pairs of wings black and the front ones having a broad outer and posterior band of white. The colours much more intense than in *paulina*. Took also three fine *viduata*, *cara*, *neogama*, two faded *serena* and *palæogama*. The *lacrymosa* was a female, and so was the *nebulosa*.

Moths were mostly low on the trees and abundant everywhere, even at the mouth of the hollows where there was but little shade.

The 13th was dry and hot, and moths were not scarce. Took a *paulina*, *cara*, *palæogama*, *neogama*, *retecta*, *phalanga*, *residua* and ragged examples of *ilia* were very abundant. Miss Wallace took a second *junctura* on this date.

July 15th took six *Catocala viduata*, all males, four *retecta*, one brand-new *ilia* and a ragged *dejecta*.

Weather hot and dry. Few Catocalæ in the hollow, more on the hillside. *Viduata* is almost always at rest on white oak trees and usually under the leaves of vines, but rarely nearer the ground than four feet. When scared out of their resting places, they simply fly higher or around to the other side. They seem lazy. *Innubens* and *palæogama* stay near the bottoms of the trees in dry hot weather, and so do *neogama*, *cara*, *innubens*, *nebulosa* and *junctura* under roots along the little brooks. *Junctura* rests also under porches, in deserted sheds and under bridges.

(To be continued.)

FIELD NOTES AND QUESTIONS.

The Insect Fauna of the New Jersey Coast.

The coastal strip of New Jersey, which is that portion of the state bordering on the Atlantic Ocean, consists of the beach front and the sand hills immediately back of it, the marshlands lying between the beach and the mainland and various islands composed of different types of soil found chiefly in the southern portion of the coastal strip. These islands contain sandy areas, some agricultural land, salt marsh, cedar and sphagnum swamps, and have a varied flora. As a result, their insect fauna is correspondingly rich and many species occur there which are also found throughout the state.

The following information, compiled from Smith's "Insects of New Jersey," gives one an idea of the characteristic insect fauna of the marshlands and beach, both of which have been fairly well collected over. The Odonata of the beach number nine species, representing three families, and of the marshland, two species from two families. In the Homoptera, thirteen species occur on the marshland, seven of which belong to the Jassidæ, five to the Fulgoridæ, and one to the Coccidæ, while none is found on the beach.

The Hemiptera is poorly represented on both beach and marshland, one family and two species being found on the former and two families and two species on the latter. The Orthoptera of the beach number five species and two families, and of the marshland, seven species and two families. Of the Coleoptera, seventy-one species and twenty-two families occur on the beach and fifty-six species and fourteen families on the marshland, this order being the best represented on the coastal strip. Of the seventy-one species on the beach, seventeen belong to the Carabidæ, and of the fifty-six on the marshland, thirty-one belong to the same family.

The Lepidoptera is poorly represented on the beach by one species and one family, but on the marshland, eleven species and five families are found. In the Diptera, six species belonging to the family Tabanidæ are found on the beach, while on the marshland twelve species, representing the two families, Culicidæ and Tabanidæ, occur.

It must be remembered, of course, that overlapping takes place, it being impossible to separate the areas sharply from each other or from the adjoining section of the state.

HARRY B. WEISS,
New Brunswick, N.J.

A EUROPEAN BEETLE, RECENTLY INTRODUCED INTO CANADA.
(*Orchestes scutellaris.*)

This spring, while sweeping on the border of a wood—not far from the city of Ottawa— where small willows and raspberry bushes were growing, I captured an interesting small "Curculionid." The specimen was sent to the Bureau of Entomology, Washington. Mr. Schwarz, who identified it, sent me the following note: "Your beetle is a European species hitherto not known to occur in North America. It belongs to our jumping Curculionidæ (genus *Orchestes*), which have the hind femora incrassate. It is easily known by its brownish coloration, our common species being all black, or black with white markings."

The specimen has been kept for the U. S. N. M.

Ottawa, July, 1915. BRO. GERMAIN.

BOOK REVIEWS.

THE BUTTERFLY GUIDE: A Pocket Manual for the ready identification of the common species found in the United States and Canada. By W. J. Holland, LL.D. Doubleday, Page & Co., Garden City, New York. (Price $1.00.)

This little book is published in the same form as the well-known Bird, Flower and Tree Guides, with flexible covers, and in shape and size convenient for carrying in the pocket. It consists of 237 pages, and is illustrated with 295 coloured figures, representing 255 species and varieties. There are also five plates in explanation of structure, venation, metamorphosis, and the apparatus required for catching, breeding and mounting specimens.

The first sixty pages give an admirable introduction to the scientific study of the Diurnal Lepidoptera, explaining clearly the

external and internal anatomy of Butterflies, the wing-venation, and the life-history during the four stages of metamorphosis. This is followed by full directions for collecting and preserving specimens. A careful study of this introduction, written as it is in simple language, will enable the reader to understand the classification, and to realize that the Butterflies he captures are something more than a collection of pretty objects.

The coloured figures, though they necessarily fail in some cases to represent the splendour of the originals, are true to nature and will enable anyone to identify the larger species almost at a glance; for the Skippers and other small forms it will be necessary to consult also the descriptions and comparisons given in the text. The possession of this handy little book will be a permanent joy to every collector of these lovely "winged flowers of the air," and it ought to find a place among the Nature study books of every school library, as well as in the pocket of everyone who takes delight in the beauties of the world around him.

Dr. Holland's Butterfly and Moth Books were the first publications which gave coloured illustrations of the insects at a price within the means of those most interested, and deservedly met with a very large sale. Our debt of gratitude to the author is now largely increased by the work before us, which is so much cheaper and handier, and which includes all our Canadian Butterflies, with the exception of a few very rare species.

C. J. S. B.

Indian Forest Insects of Economic Importance. Coleoptera. By Edward Percy Stebbing, London. Eyre & Spottiswoode, Ltd., 1914. Price 15 shillings.

It may come to many as a surprise to see a volume of 648 pages on a single order of Indian forest insects, as we are accustomed to think of the vast insect fauna of India as too little known to render possible the preparation of such a work, and while Prof. Stebbing's book, as the author modestly remarks, "has no pretensions to be more than a pioneer endeavouring to indicate in some small degree the lines upon which the further study of the subject should proceed," there is nevertheless a vast amount of

information contained within it on the life histories and economic relations of the beetles that are more or less destructive to Indian forests.

Some idea of the vastness of the subject may be gained from the author's statement, quoted from J. S. Gamble (Manual of Indian Timbers) that "the Indian forests contain some 5,000 different species of trees shrubs, climbers and bamboos"; for here, as elsewhere, the number of species of insects corresponds more or less closely upon that of the plants on which they feed.

The material for the present work was chiefly gathered by the author since 1898 while acting in the capacity of Imperial Forest Zoologist and Member of the Forest Research Institute, Dehra Dan, India.

The first five chapters deal with the more general phases of the subject, such as the distribution of forest insects in India (Chap. I), the methods by which the presence of insect pests in the forest can be ascertained, the general methods of control and the characteristics of the order Coleoptera. The special part treating of the various families and species of beetles, which are arranged according to Lefroy's *Indian Insect Life*, comprises the remaining 27 chapters. It deals with a very large number of species, about most of which very little is known; but the life histories of not a few of the more destructive species have been worked out by the author, and their economic relations, methods of control, etc., are given in considerable detail.

A good many of the species noticed are of no economic importance, all species showing any definite relation to trees or tree-products being included, on account of the necessity , on the part of the forester, of being able to recognize such species and distinguish them from the truly injurious forms.

There are no keys, but descriptions of all the species dealt with are given and a very large proportion are figured. Unfortunately a great many new species are described, an undesirable feature in an economic treatise. This was perhaps difficult to avoid, however, in the present work, as it is possible that the publication of so many new species in the regular journals might have caused serious delay in the issue of the book.

The illustrations include 64 plates, of which seven are coloured, and 401 text figures. They are of very variable quality, being the work of several different artists. The great majority are excellent in every respect, some of the plates, such as Plate XV, on which a group of Buprestids is shown in colour, being of great beauty and finish. Some of the coloured plates, however, are poor, and among the text figures are a few exceedingly crude sketches, which look like rough field notes that had never been intended for reproduction.

As a pioneer effort in the study of Indian forest insects, the book is deserving of great praise and will undoubtedly be the most useful work on the subject of Indian forest beetles for many years hence. We look forward with pleasure to the appearance of the next volume in this series.

A Preliminary List of the Insects of the Province of Quebec. Part II—Diptera (Two-winged Flies). Compiled by Albert F. Winn (Westmount) and Germain Beaulieu (Ottawa). Published as a supplement to the 7th Report of the Quebec Society for the Protection of Plants, 1915.

We received with much pleasure recently a copy of Part II of the Quebec List of Insects, dealing with the Diptera or Two-winged Flies. As so few entomologists in Canada have given any attention to the systematic study of this order, it was with some surprise that we noted the names of nearly 800 species in the list. This number must, of course, be very far short of the actual number of species which inhabit the Province, but it is a very creditable beginning, and sets an example that should be emulated by entomologists in other Provinces.

The same plan is followed in this list as in that of the Lepidoptera, except in the omission of illustrations—an improvement in our opinion.

The localities given for species are naturally fewer than is the case of the Lepidoptera, there being fewer collectors of this order. A large proportion of the species were collected by the junior author and Mr. G. Chagnon, of Montreal.

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POPULAR AND ECONOMIC ENTOMOLOGY.

The Establishment of Foreign Insects in spite of Inspection.

BY HARRY B. WEISS, NEW BRUNSWICK, N.J.

At Rutherford, N.J., are located two large nurseries which import a considerable quantity of nursery stock from Europe, Asia and South America every year. During the spring of 1914 three thousand seven hundred and forty-four cases of imported stock were consigned to Rutherford; during the fall of 1914 the number of cases was one thousand seven hundred and sixty-five, and during the spring of 1915 two thousand one hundred and ninety-one cases were received. From these figures, representing the combined imports of the two firms, one can get some idea of the enormous numbers of imported plants which are set out in this vicinity and later distributed to various points in the United States and possibly Canada.

During the inspection seasons, one or more men are stationed at Rutherford for the purpose of examining this stock as it comes in, and all possible precautions are taken to see that nothing undesirable is introduced. Yet, in spite of this, the following foreign species have recently become established in that vicinity.

Phytomyza aquifolii Gour. was lately found mining the leaves of English holly. This species has also been taken, mining the leaves, on English holly imported from Holland. In May, 1915, the European pine-shoot moth, *Evetria buoliana* Schiff was taken in *Pinus mughus* growing in the nursery. During August, 1913, *Agrilis viridis* Linn. var. *fagi* Ratz. was found infesting rose stems and doing considerable damage in this as well as in other sections of the state.

In January, 1914, *Aspidiotus tsugæ* Marlatt was taken in considerable numbers on Japanese hemlock. Since that time, however, all infested trees found have been destroyed.

Myelophilus piniperda Linn., which often does extensive damage to pine trees in Europe, was also found at Rutherford in *Pinus sylvestris*. In 1909 Dr. J. B. Smith had his attention called

to the European Red Tail, *Dasychira pudibunda* Linn., which had been bred from pupa collected near Rutherford. This insect is widely distributed in Europe and parts of Asia, and ranks as a first-class pest along with the Gipsy and Brown-tail Moths.

During June, 1915, a species of *Pseudococcus*, evidently from Japan, was found doing considerable damage to *Taxus* sp., originally from that country, and in July, 1915, a mole-cricket,* as yet unidentified but supposedly from Europe, was found in comparatively large numbers feeding on the roots of various plants. In addition to the above foreign species, Rutherford has also received unwelcome insects from other states, the most important being the Gipsy Moth and the Florida Fern Caterpillar, *Callopistria floridensis* Guen. The Gipsy Moth infestation has, of course, been entirely destroyed.

With one or two exceptions, the above established infestations are light, but it is only a question of time before they will become more troublesome. On account of the similarity between the climate, animals and plants of North America and the northern parts of Europe and Asia, various European pests do very well in this country, especially when allowed to develop unchecked by parasitic enemies and cultural methods. Imported nursery stock is undoubtedly the greatest source of danger, although some species come over in merchandise, or in the packing around merchandise, while others are accidental passengers on boats. Many of our now common and destructive pests were imported before quarantine laws and inspection systems were in force.

The well known San José scale is probably a native of central China. The Gipsy Moth, *Porthetria dispar* Linn. is a serious pest in Europe, and occurs in Asia and northern Africa. The Brown-tail Moth, *Euproctis chrysorrhœa* Linn., is from central and western Europe. The codling moth, *Cydia pomonella* Linn., the pear psylla, *Psylla pyricola* Foerst., the clover leaf weevil, *Phytonomus punctatus* Fab., the clover root-borer, *Hylastinus obscurus* Marsham, the seed corn maggot, *Pegomya fusciceps* Zeit., the pea moth, *Semasia nigricana* Steph., the carrot rust fly, *Psila rosæ* Fab., the imported onion maggot, *Pegomyia ceparum* Bouche., both asparagus

* This has since been determined by Mr. J. A. G. Rehn as *Gryllotalpa gryllotalpa* Linn., the European mole-cricket.

beetles, *Crioceris asparagi* Linn., and *C. 12-punctata* Linn., the strawberry leaf-roller, *Ancylis comptana* Frohl., and the imported cabbage worm, *Pontia rapæ* Linn., are all of European origin.

The alfalfa weevil, *Phytonomus murinus* Fab,. is a native of Europe, western Asia and northern Africa; the Mexican cotton boll weevil, *Anthonomus grandis*, came from Central America and Mexico, the sugar beet web-worm, *Loxostege sticticalis* Linn. from Europe and northern Asia, the harlequin cabbage bug, *Murgantia histrionica* Hahn., from Mexico and Central America, the Angumois grain moth, *Sitotroga cerealella* Oliv. from Europe and the Argentine ant, which has recently become such a pest in the Southern States, from Argentina.

Various other pests have also come to us from abroad, among which are the elm leaf-beetle, *Galerucella luteola* Mull., the wood leopard moth, *Zeuzera pyrina* Linn., the Hessian fly, *Mayetiola destructor* Say., the hop plant-louse, *Phorodon humuli* Schrank, the willow and poplar curculio, *Cryptorhynchus lapathi* Linn., the apple aphis, *Aphis mali* Fabr., the elm bark louse, *Gossyparia ulmi* Geoff., the bed-bug, *Acanthia lectularia* Linn., the Buffalo carpet-beetle, *Anthrenus scrophulariæ* Linn., the larder beetle, *Dermestes lardarius* Linn., and the rice weevils, *Calandra granaria* Linn.,and *oryzæ* Linn.

The above list, while not by any means complete, will serve to show the importance of introduced species. The injuries caused by these imported pests are, of course, perfectly enormous, and, running as they do into millions of dollars, are beyond reasonable calculation.

While inspection service is doing considerable to prevent the establishment of foreign insects, it is not by any means complete, and, as has been suggested before, a federal law prohibiting the importation of all nursery stock would be the nearest approach to perfection.

A NEW MIDGE FROM GUATEMALA.

BY T. D. A. COCKERELL, BOULDER, COLORADO.

Hardly anything is known of the Chironomid fauna of the highlands of Central America, but it cannot be doubted that these regions are rich in species still awaiting discovery and description. When Mrs. Cockerell was in Guatemala City, although not specially concerned with Diptera she obtained a couple of specimens of a new form which is described herewith.

October, 1915.

Chironomus gualtemaltecus, n. sp.

♀—Length about 6 mm., wing 4 mm., anterior tarsus 5.75 mm. Antennæ 7-jointed, pale ochraceous, last joint black; length of joints in microns: (2) 64, (3) 144, (4) 136, (5) 128, (6) 96, (7) 224; first joint very broad, cushion-like; second short, cylindrical, slightly swollen apically; 3 to 6 flask-like, bulbous at base, narrow and neck-like apically; 7 narrow and cylindrical, tapering apically; joints 2 to 6 with very long hairs (one hair on 4 fully 333 microns long, one on 6 288 microns); 7 with much shorter (about 65-80 microns) curved hairs. Palpi dusky. Thorax finely hairy, pale ochraceous; mesonotum dull (the bands faintly shining), with three reddish or reddish-fuscous longitudinal bands, the middle one divided into two by a fine median line and ending abruptly posteriorly a little beyond middle of mesonotum; lateral bands very broad, evanescent anteriorly; scutellum pale yel owish; metathorax rufofuscous; halteres with dark knob. Abdominal segments with basal half or rather more (especially on segments of apical half) black, and apical border pale ochraceous. Legs very pale ochraceous, marked with dusky; femora with a suffused dusky subapical ring; anterior tibiæ with more than the basal half, as well as the extreme apex, dusky; middle and hind tibiæ dusky at extreme apex, and faintly so at base; tarsal joints dark at apex; anterior tibiæ 1408–1440 microns long, anterior basitarsi 1370–2495. Wings hyaline, iridescent, with very pale veins, a dark spot at cross-vein as in allied species; fork of vein 5 a little beyond level of fork of 3–4; end of vein 3 very near wing tip, about as in *C. fallax*, but wing is narrower in proportion to its length than in that species; three very distinct anals.

Hab.—Guatemala City, Guatemala (*W. P. Cockerell*).

In Johannsen's key (Bull. 86, N. Y. State Museum) it runs to *C viridicollis*, which differs in many details; in the auxiliary key it falls near *C. albistria* Walker, from Hudson's Bay. In Malloch's key (Bull. Ill. Lab. N. Hist., X, p. 416 et seq.) it falls near *C. serus* or *C. decorus*. It is actually very close to *C. decorus*, differing especially by the dusky anterior tibiæ and lack of greenish colour. I am indebted to Professor Johannsen for specimens of *C. decorus* (as well as a number of other species), and find that the species is undoubtedly distinct.

A CONTRIBUTION TOWARDS THE TAXONOMY OF THE *DELPHACIDÆ*.

BY F. MUIR.

Hawaiian Sugar Planters' Experiment Station, Honolulu, T.H.

(Continued from Page 302)

Three New Genera.

Lanaphora, gen. nov.

Head narrower than thorax; vertex quadrate, the base as broad as the length, apex half the base, a small carina along base and apex; face narrow, sides straight, apex about twice the width of base, a small simple carina down middle; the lateral carinæ of vertex and face developed into deep keels, diminishing in size towards the apex of face; clypeus nearly as long as face, tricarinate. Antennæ longer than face and clypeus together, joints subequal in length, arista apical and long; first joint narrow, slightly flattened, second joint terete with distinct sense organs surrounded with minute hairs; eyes wide with deep antennal emargination on lower edge. Pronotum very slightly emarginate posteriorly, tricarinate, lateral carinæ straight or very slightly convergingly curved, reaching hind margin. Mesonotum tricarinate. First joint of hind tarsus equal to the other two together, spur cultrate, thick, inner surface concave, a minute tooth at apex; no teeth on hind margin, only minute fine hairs; one basal and one median spine on hind tibiæ, five small apical spines. Tegmina pointed at apex, radia not touching media, a short radial cross-vein present, median with two sectors, cubitus touching radia at base of first sector.

This genus differs from *Purohita* in the subequal joints of the antennæ, the basal one of which is not foliaceous, and the lateral carinæ of the face being deeper. If we disregard the spur it comes, along with *Purohita*, next to *Sparnia*.

Type—*L. bakeri.*

Lanaphora bakeri, sp. n.

♂ Light yellow or yellowish white, darker on face, clypeus, coxæ and basal portion of abdominal segments; some darker brown spots on lateral keels of vertex and face, antennæ, especially a ring at base of second joint, and two small irregular rings on tibiæ;

slightly darker between carinæ of pro- and mesonotum. Tegmina hyaline, veins white speckled with brown dots, six irregular light brown spots in basal half, one at end of clavus, one at base of media, one at middle of costa, one at middle of radia and two in median cells; a broad brown mark from end of clavus across tegmina to near costal margin, and along hind margin to near end of cubitus, along second median cell to apex and from end of costal cell to end of radia; wings hyaline with white veins.

Pygophor round, a small pointed process on medio-ventral edge, lateral edges subangularly produced; anal segment a little longer than broad, tubular with anus situate within apex; styles reaching end of anal segment, narrow, flattened, straight on ventral (inner) edge, slightly sinuous on dorsal (outer) edge, narrowing to near apex, where it broadens out and bends at right angle to main part, apex truncate.

♀ Anal segment shorter than in male, anal style narrowly lanceolate.

Length 2.5 mm.; tegmen 4.3 mm.*

Hab.—Mount Maquilin, living at base of leaf-sheath of bamboos among a white, flocculent secretion. Prof. C. F. Baker called my attention to this and the following species when at Los Banos. (Baker and Muir, February.)

Bambucibatus, gen. nov.

Head narrower than thorax base as wide as length, apex much narrower than base, truncate or but slightly curved, lateral carinæ large, an exceedingly obscure medio-longitudinal carina; length of face more than double the width, base slightly narrower than apex, the simple median and lateral carinæ well developed, clypeus tricarinate; antennæ a little longer than face, joints subequal in length, first broad, flattened narrow at base, wide at apex, subtriangular, a keel down middle, second terete, thick.

Pronotum roundly and shallowly emarginate posteriorly, tricarinate, lateral carinæ straight or slightly convergingly curved, distinctly reaching hind margin; mesonotum tricarinate. Hind tibiæ with one basal, one median and five small apical spines;

*Measurements are from apex of vertex to anus and from base to apex of one tegmen.

spur cultrate, solid, convex on inner surface, a small apical tooth but no teeth on hind margin. Tegmina narrowly rounded at apex, media straight, not bent to touch radia, radial cross-vein present, first median sector bent, touching cubitus.

This genus comes next to *Sagotopsis*, but differs in having the first segment of antennæ flattened and triangular. If we disregard the nature of the spur it comes near *Perkinsiella* and *Sago opsis* near *Sparnia*.

Type—*B. albolineatus*.

Bambucibatus albolineatus, sp. n.

♂ Light brown, ventral surface and legs lighter, dorsum of abdomen darker. A white or light yellow median line from apex of vertex to end of mesonotum, bordered on each side with dark brown or black; antennæ darker brown. Tegmina brown with colourless patches, a large colourless patch in middle of costal cell, a large one at end of clavus extending to media, three from end of costal cell to second median sector, a small one at end of radia; wings hyaline with brown veins. Pygophor laterally compressed, long on ventral surface shortening to the very short dorsal surface, two small spines on medio-ventral edge; anal segment short, tubular, anus in apex; styles very short and narrow, widest at base, slender in middle and narrowly spatulate at apex.

♀ Anal segment very short, tubular, anus in apex, anal style spatulate, short, broad.

Length 2.5 mm.; tegmen 3 mm.

Hab.—Singapore, under the leaf-sheaths of bamboo. (Muir, February.)

Several specimens contain *Stylops* puparia.

Arcofacies, gen. nov.

Vertex at base broader than length, apex narrower than base, truncate with outline broken by facial carina, lateral edges distinctly keeled, no medio-longitudinal carina or exceedingly faint; length of face more than twice the breadth, sides very slightly arcuate, tricarinate, carina deep, especially the median carina at apex; in profile vertex and face at right angles; clypeus strongly curved, at right angles to face, tricarinate; diagonal carina on gena distinct.

Antennæ as long as face, terete, first joint more than half the length of second. Hind margin of pronotum shallowly and roundly emarginate, tricarinate, lateral carinæ convergingly curved, meeting hind margin; mesonotum long, tricarinate. Hind tibiæ only slightly longer than tarsi, one basal, one median and five apical spines; spur cultrate, thick, convex on inner surface, apex with tooth, hind edge without teeth. Tegmina at rest tectiform, sub-acinacicate, radia not quite touching media, a short radial cross-vein below first median sector, cubitus touching first median sector near base, then bent at right angle.

Type—*A. fullawayi.*

This genus comes near to *Tropidocephala*, especially to such forms as *neoamboinensis*, but its quadrate vertex, long antennæ and tectiform tegmina at once distinguish it.

Arcofacies fullawayi, sp. n.

♂ Light green or yellowish, a white median line from apex of face to end of mesonotum bordered with black, antennæ indistinctly ringed with dark brown, a light band bordered with brown across the lateral portions of pronotum, pygophor and apex of abdomen brown; tegmina light brown over basal third, rest hyaline broadly marked with black, the markings extending from hind margin over middle of cubitus, base of first median sector, radial cross-vein, along radia and subcosta to costal margin, and over media and second median sector to apex; in the dark portion the veins bear white spots, a series of black spots along cubitus, semi-hyaline mark along inner margin of clavus; apical edge of tegmen sinuous; wings hyaline with brown veins.

Pygophor slightly compressed, ovate, a small rounded projection on lower edges of sides, anal segment short, anus at apex, below anus roundly emarginate with rounded corners projecting, but no spines; styles long, reaching to anal segment, base broadest and flattened, tapering to fine apex which is slightly curved and flattened.

♀ Styles (ovipositor sheath) compressed laterally above base.

Length 2.5 mm.; tegmen 3 mm.

Hab.—Manila (D. T. Fullaway, March; Muir, February).

NOTES AND DESCRIPTIONS OF TENTHREDELLA (HYM.)

BY M.T. SMULYAN, PH.D., AMHERST, MASS.*

The following descriptions and notes on the Tenthredinid genus *Tenthredella* are offered here preliminary to the publication of a paper on the New England species of this genus.

Tenthredella nortoni, n. sp.

The type is in the collection of the United States National Museum: No. 19093.

Type locality—Massachusetts.

Male—Head: Straw colour; the following parts black: the back of head, a large spot on front above antennæ and vertex distinctly trilobed anteriorly and somewhat less distinctly laterally, extending from the posterior margin of the head to between the bases of the antennæ mesally and connecting rather narrowly about half way between the posterior margin of the eye and the posterior margin of the head with a smaller elongate spot behind the upper part of the eye and which extends back about half way towards the posterior margin of the head; an elongate brownish spot on the posterior half of cheek, the upper portion of which is black; antennæ black, the inside of the basal segment in part rufescent, or straw colour. Head behind eyes distinctly narrower than through them; vertex plate quite convex; supraantennal ridges fairly prominent.

Thorax black; the following parts straw colour: prosternum except medially and longitudinally, a minute spot on the ventral face of the propleura on each side, margin of pronotum (interrupted dorsally), which may broaden out on the posterior dorsal margin of the lobes of collar and on the lower portion of the lateral face of the pronotum, pronotal lobe, a V-spot on prescutum, tegulæ (brownish in part), transverse mesoscutel extensions, upper margin of mesoepimeron, an approximately right-angled band on the lower limit of mesoepisternum (wider on the anterior half) and which may be narrowly interrupted about in the middle, pectus except a rather broad band on each side and more narrowly meso-anterior-

* Contribution from the Entomological Laboratory, Massachusetts Agricultural College.
October, 1915.

ly, a large spot on the metaepisternum, upper margin of metaepimeron narrowly, transverse metascutel extensions, and the upper margin of the metapostscutellum narrowly sometimes. Mesoscutellum fairly strongly convex; mesoepisternum sharply pointed.

Abdomen—From pale to quite pale ferruginous; two basal terga completely and more or less of the third or third and fourth except medially and longitudinally, black; sides of basal tergum and basal half of venter straw colour.

Legs—Straw colour; the following parts black: the outside of the anterior coxæ more or less and the intermediate above or above and outside, the posterior coxæ except the inner face and the inner longitudinal half beneath, a longitudinal band on the anterior and intermediate femora above (it may be abbreviated in greater part towards the base on the former), the posterior femora behind and faintly at base before, a longitudinal line on the anterior and intermediate tibiæ above which broadens out apically, posterior tibiæ entirely or almost entirely, the intermediate tarsi above and the posterior except the apical segment (may be only brownish in both).

Wings—Fore wings hyaline, or faintly clouded; costa may be brown; stigma brown to dark brown; costal cell only slightly translucent and quite strongly beyond costal cross-vein; veins blackish. Hind wings hyaline, apical portion may be very faintly clouded; veins brownish to blackish.

Length—9–10 mm.

Described from one specimen.

This species may be Norton's *angulata*, the type of which is lost. It answers fairly well to the description of *angulata*, except in an important respect in connection with the coloration of the head, viz., the presence of the lobate black spot on the front above the antennæ and vertex. It is possible, of course, that Norton failed to mention this, but he noted it in describing *lobata* and *angulifera*, both of which were described previous to *angulata*. The lobate spot in *lobata* and its relation to the black behind the upper part of the eye, which is the same as in *nortoni*, is accurately noted in a later redescription of *lobata* (Trans. Am. Ent. Soc., II, 1868–9, p. 229), but the redescription of the coloration of the head

of *angulata* in the same publication does not differ materially from the original description.

Habitat—Mass.; N. Y.; N. J.

Tenthredella rohweri (new name).

Allantus tricolor Harris, ms. (nomen nudum).

Allantus tricolor Norton, Bost. Jour. Nat. Hist. VII, 1860, p. 247, n. 22, ♀.

Tenthredo tricolor Norton, Trans. Am. Ent. Soc. II, 1868–9, p. 236, n. 22, ♀ (preoccupied).

The type is in the Harris Collection in the Museum of the Boston Society of Natural History, Boston, Mass., manuscript number 515; in rather poor condition. It was taken by J. W. Randall in 1836, probably in the vicinity of Hallowell, Maine.

Tenthredo tricolor being preoccupied, a new name is necessary for this species.

Tenthredella macgillivrayi, n. sp

Tenthredo mellinus var. *a*. Norton, Trans. Am. Ent. Soc. II, 1868–9, p. 227, n. 2, ♀.

The specimen of *T. mellinus* var. *a*. Norton, which I select as the type of this species is Norton's original specimen, and is in the Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts. Type locality, Norway (Norton), Maine.

A paratype from New Hampshire ("Twin Mt.") is in the collection of the New Hampshire Agricultural Experiment Station, Durham, New Hampshire.

A metatype from New York (Gloversville) is in the New York State Collection, New York State Museum, Albany, New York.

Female—Head: Dark ferruginous; the following parts yellow: clypeus, labrum, mandibles, a small spot at the base of the antennæ near eye, and a very faint, narrow, complete, or partial, inner orbit (in a New York specimen which I have seen the inner orbit was more distinct), a small spot in the anterior portion of the frontal fovea, and the occiput narrowly below and on the sides, black. Head behind eyes only very slightly narrower than through them; supraantennal ridges fairly prominent and sometimes only to about half way towards the anterior ocellus.

Thorax—Dark ferruginous; the following parts black: prosternum, propleura, lateral face of pronotum in part faintly, a large

spot on the mesoscutum on each side, the lower margin of the mesoepimeron in part sometimes, small posterior medial portion of pectus, and the metascutum anterior to cenchri; tegulæ and metaepisternum pale yellow. Mesoscutellum only slightly convex; mesoepisternum from fairly sharply to quite sharply pointed.

Abdomen—Dark ferruginous; sides of basal tergum yellowish-white.

Legs—Darkish ferruginous (paler towards the extremities); anterior pair yellowish before; coxæ sometimes slightly at the base, and approximately the apical half of the posterior femora except beneath, black.

Wings—Front wings pale honey-yellow; stigma brown, basal half paler; costal cell from fairly to quite strongly translucent; veins black, or blackish, brown towards base of wing. Hind wings faintly honey-yellow; veins brown.

Length 10.5—11 mm.

Described from two specimens.

The four specimens which I have seen are quite constant, and are apparently quite distinct from *mellina* (Norton).

Habitat—Norway (Norton), Me.; Twin Mountain, N. H.; Gloversville, N. Y. (Aug.); "Can."

Tenthredella cinctitibiis abdominalis, n. subsp.

The type is in the collection of the United States National Museum; No. 19094.

Type locality—"Carriage Road," Mt. Wasington, N. H. (Mr. Geo. Dimmock).

Female—Differs from *cinctitibiis cinctitibiis* in having the abdomen beyond the fourth segment ferruginous and the mesoscutellum only very slightly convex.

Length 11 mm.

Described from one specimen.

There is another specimen of the same sex in the National Museum, but it bears no locality label.

Tenthredella lobata maculosa, n. subsp.

Allantus lobatus var. *a.* Norton, Bost. Journ. Nat. Hist. VII, 1860, p. 253, n. 32, ♀.

Tenthredo lobatus var. *a*. Norton, Trans. Am. Ent. Soc. II, 1868–9, p. 229, n. 6, ♀.

Norton's specimen of var. a., as far as I know, is lost, but there is an authentic female specimen from "Connecticut" in the Norton Collection in the Peabody Museum, Yale University. Can this specimen be the original one?

Type locality—Farmington, Connecticut.

Female—Differs from *lobata lobata* as follows:

Head—A yellowish, or yellowish-white spot, or longitudinal line usually on the posterior portion of the vertex plate on each side, very often a minute elongate spot at the terminus of each arm of the epicranial suture; the black spot on the posterior half of the cheek sometimes coalesces with that along the upper part of the eye; basal segment of antennæ usually black inside, and the yellowish line outside sometimes absent. Supraantennal ridges from moderately prominent to prominent.

Thorax—Margin of pronotum not interrupted antero-dorsally; V-spot on prescutum very often not complete posteriorly; the following additional parts yellow or yellowish-white; a short longitudinal line on the mesoscutum on each side of the posterior portion of the prescutum a triangular spot at the posterior end of the mesoscutum immediately in front of each anterior angle of the mesoscutellum, the anterior margin of the mesoscutellum in part rarely, a small spot on the metascutum behind and under each cenchrus, and the greater mesal upper half of the metapostscutellum; as a rule only a small spot at the upper anterior angle of the mesoepisternum, and very often a small yellowish-white, or straw-coloured spot at the posterior end of the pectus on each side of the median longitudinal suture. Mesoscutellum from slightly to moderately convex; mesoepisternum from moderately to fairly sharply pointed.

Abdomen—Venter with only the pleura straw colour.

Legs—Trochanters black above, sometimes almost entirely; anterior femora usually black behind; very frequently intermediate femora black except more or less before; the black on apical portion of posterior tibiæ often more extensive above—about half way up towards base.

Wings—Fore wings sometimes hyaline; costa not brown.

Described from a type and five paratypes, the female in the Peabody Museum referred to above being selected as the type. Two of the paratypes are in the collection of the Boston Society of Natural History, two in the collection of the American Entomological Society at Philadelphia, and the fifth is in the collection of the Conn. Agricultural Experiment Station at New Haven, Conn.

Male—The male differs from the female as follows: Greater part of lateral face of pronotum straw colour; an approximately right-angled band on the mesoepisternum, posterior mesal half of pectu, and basal half of venter entirely, straw colour; intermediate coxæ black only at base above, the posterior coxæ except inside and inner longitudinal half beneath, and the apical two-thirds of the posterior tibiæ black (continued to base above).

Length—Female 11–13 mm.; male 11 mm.

The male is here for the first time described, and is the only one that I have seen. It belongs in the collection of the Boston Society of Natural History.

This subspecies approaches *fisheri* Rohwer from Maryland, and may prove to be the same.

Habitat—Sharon, Auburndale, and Woods Hole, Mass. (June and July); Farmington (Norton) and Westville, Conn. (June). I have records also from New York, New Jersey, and Virginia, but they may refer to *lobata lobata*.

INSECT IMPORTATIONS INTO NEW JERSEY DURING THE SPRING OF 1915.

BY HARRY B. WEISS, NEW BRUNSWICK, N.J.

The following insects arrived in New Jersey during the spring of 1915 on nursery stock imported from various countries in Europe. Practically all were alive when taken and many came over in numbers sufficient for them to gain quite a foothold. Identifications, for the most part, were made by specialists through the courtesy of the U. S. Bureau of Entomology.

October, 1915.

Homoptera.

Pseudococcus sp. on palms and rubber plants from Belgium and Taxus sp. from Japan. *Coccus hesperidum* Linn. on bay trees from Belgium. *Chrysomphalus dictyospermi* Morg. on palms from Belgium. Plant lice on maples from Holland. *Lepidosaphes ulmi* Linn. on boxwood from Holland. *Targionia biformis* Ckll. on orchids from Brazil. *Aulacaspis rosæ* Bouche on rose stocks from France. *Parlatoria pergandei* Ckll. on maples from Japan. *Pseudaonidia pæoniæ* Ckll. on azaleas from Japan and *Chrysomphalus perseæ* Comst. on orchids from Central America.

Lepidoptera.

Evetria buoliana Schiff. on Pinus montana, Pinus mughus, Pinus wateriana from Holland. *Apatela rumicis* (pupæ) on roses from France. *Apatela auricoma* (cocoon) on shrubs from France. *Psychid* cases on azaleas from Japan. Pyralid or Tortricid larva on rhododendrons from Holland. Noctuid larva in packing from France. Lepidopterous larvæ on boxwood tips from Holland.

Coleoptera.

Rhynchophrid larva in soil around roots of blue spruce from Holland. *Agriotes* sp. (larva) in soil around rhododendron roots from Holland. Curculionid larva in soil around rhododendron roots from Holland. *Hister stercorarius* Hoff. in soil around rhododendron roots from Holland. *Cercyon hæmorrhoidalis* Fab. on rhododendrons from Holland. *Trechus* sp. (carabid) on azaleas from Japan.

Hymenoptera.

Isosoma orchidearum punctures in orchids from Brazil, Guatemala, U. S. of Columbia and Venezuela. *Dryophanta longiventris* Hartig (galls) on oaks from France. *Itoplectis* and *Brachycryptus* spp. from cocoons on azaleas from Japan.

Diptera.

Phytomyza aquifolii Goureau (leaf miner) in English holly

from Holland. Cecidomyid gall on pine from Japan. Larvæ (*Ortalidæ*) in soil around roots of blue spruce from Holland.

Hemiptera.

Tingitid eggs on rhododendrons from Holland.

Acarina.

Notaspis (Oppia) sp. on boxwood from Holland.

The only desirable members of this list are *Hister stercorarius*, which is insectivorous and possibly the Hymenopterous parasites *Itoplectis* and *Brachycryptus* spp. With the exception of *Cercyon hæmorrhoidalis*, which feeds on decaying vegetable matter and is therefore of no economic importance, most of the other species are, to a greater or lesser extent, injurious. The most unwelcome importation was *Evetria buoliana*, the European Pine Shoot Moth, which came over in the larval stage in surprising numbers on six shipments of pines from Holland. As many as ten infested buds were found on numerous plants. Two shipments were burned entirely and all buds on the remainder trimmed off and destroyed.

In point of numbers, the Homoptera as usual occupy the first place. The following table shows how the different orders have been represented on imported stock during the past three seasons in New Jersey.

	Spring, 1915	Spring, 1914	Fall, 1914
Acarina	1	1	0
Lepidoptera	7	3	2
Coleoptera	6	6	0
Hymenoptera	4	3	1
Homoptera	9	18	11
Hemiptera	1	2	1
Diptera	3	0	0
Orthoptera	0	1	1

Insect importations will undoubtedly continue just as long as nursery stock is imported and the protection afforded by inspection is necessarily only partial and sometimes ineffective, depending, as it does, on the ability and carefulness of the individual inspector.

TWO NEW TIPULIDÆ FROM NORTHERN ALBERTA.

BY W. G. DIETZ, M.D., HAZLETON, PA.

Among a small collection of Tipulidæ, collected in the Athabasca country in Northern Alberta, Canada, and sent me by Dr. C. Gordon Hewitt, Dominion Entomologist of Canada, for determination, are two species new to science, the description of which herewith follows. I wish to state that the types of all are in the Entomological Collection of the National Museum at Ottawa, Canada.

Limnobia gracilis, sp. n. (Fig. 27)

Wings spotted; marginal cross-vein at tip of first longitudinal vein, the fuscous spot at this point suboval. Halteres pale; knob dark fuscous pale at apex; femora with two brown bands before the apex.

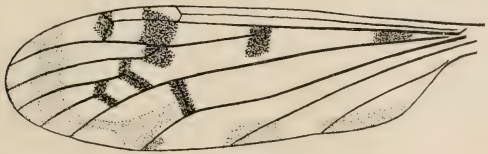

Fig. 27. *Limdobia gracilis*, wing.

Male—Length of body 8.5 mm., of wings 9.5 mm.

Legs—Middle leg: femur 7 mm., t bia 6 mm., tarsus 5.5 mm.; Posterior leg: femur 7.5 mm., tibia 7.5 mm., tarsus 6 mm.

Head fuscous, rostrum dark brown, shining above; palpi slender, fuscous, third joint yellowish, the second joint shorter than the others. Antennæ short, not reaching the anterior margin of the mesonotum, joints one and two yellowish, stout, the former longer than the latter; flagellum very slender, joints elongate, each with a few very long and some short hairs, but without whorls. Head above and beneath beset with short, anteclinal blackish hair. Occiput somewhat shining and more grayish posteriorly; orbits edged with pale yellow Eyes large, rather narrowly separated above and almost contiguous beneath.

Thorax above sordid yellow, prolonged into a long slender neck with a brown line each side of median line. Collare somewhat infuscate at middle. Mesonotum with four dark fuscous stripes, the median pair reaching from the transverse suture to the anterior margin and narrowly separated by a yellowish line; the lateral stripes abbreviated anteriorly. Pleura yellowish fuscous, with a silvery sheen. Legs sordid yellow; femora with two fuscous bands before the apex, separated by a pale band; tibiæ slightly infuscate towards the apex; outer tarsal joints fuscous; the entire leg, except the coxæ, beset with short, black pubescence.

Wings moderately wide, grayish, marked with four fuscous spots near the costal margin and nebulosities along the posterio-apical margin, as follows: A rounded spot at base of first basal cell; a trapezoidal spot at beginning of præfurca, extending from the first longitudinal vein, but not quite attaining the fourth longitudinal vein; a large subquadrate spot at end of subcostal vein; a suboval spot at end of first vein; transverse veins in apical part of wing edged with fuscous. A nebulous fascia extends across the apical part of the wing and within the wing margin into the fifth posterior cell; a nebulous patch at end of vein six and another large one in the axillary cells. The space between the third and fourth costal spots is yellowish. The marginal cross-vein is at the apex of vein one; the subcostal vein ends somewhat anterior to the proximate end of the submarginal cell, and its cross-vein runs obliquely with vein one. Halteres pale; knob dark fuscous, its apex pale.

Abdomen somewhat shining; first tergite fuscous, yellow at the sides; tergites 2–4 yellow, banded with fuscous posteriorly; fifth tergite yellowish fuscous, tergites 6–8 fuscous; underside similar to the upper. The whole abdomen clothed with short, pale pubescence. Hypopygium ferruginous, pleural lobes large, appendages recurved, beaklike, acute.

Holotype—Tsolinoi Lake—about five miles north of Athabasca Lake. July 5th, 1914.—F. Harper.

Its nearest ally is *L. cinctipes* Say, from which it differs by its smaller size and the fuscous spot at end of vein one is not circular as in that species. It resembles somewhat in coloration *L. cali-*

fornica O. S., but is very much smaller and lacks the limpid spaces in the wing markings of that species.

Dicranomyia aquita, sp. n. (Fig. 28).

Yellowish fuscous. The subcostal vein ends before or but little beyond the origin of the præfurca, its cross-vein at some distance from its apex; stigma light fuscous; discal cell closed.

Fig. 28. *Dicranomyia aquita*, wing.

Male—Length 7 mm.; wing 9.5 mm.

Head gray; rostrum yellowish, more than one-half the length of the head. Palpi and antennæ fuscous, basal joints of flagellum incrassate ovoidal, outer joints elongate, beset with short hairs, but no whorls; occiput beset with short blackish hairs.

Thorax—Collare sordid yellow and, like the neck, brown above; mesonotum grayish fuscous; three broad, but ill-defined, darker stripes; scutel and metanotum grayish; pleura sordid yellow; sterno- and upper part of pteropleura infuscate. Halteres pale, knob fuscous. Legs yellowish, apical part of femora slightly, of tibiæ markedly, fuscous; first two joints of tarsi light fuscous, remaining joints darker. Wings hyaline with faint grayish tinge, immaculate, stigma slightly infuscate, the subcostal vein ending same distance before—in some specimens almost opposite or at most very little beyond—the origin of the præfurca, its cross-vein rather remote from the apex, præfurca longer than vein three from beginning to anterior cross-vein, discal cell closed, the costal margin very closely beset with short, blackish hairs. Abdomen yellowish, with broad median, fuscous stripe, the lateral margin indistinctly margined with fuscous; hypopygium concolorous, the part supporting the large pleural lobes velvety brown.

Female—Length 8 mm.; wing 8.5 mm., similar to male; basal joints of antennal flagellum scarcely incrassate; the lateral margins

of abdomen more distinctly margined, ovipositor concolorous, upper valves robust, greatly attenuated towards the apex, which projects slightly beyond the lower valves.

Holotype—Fort Resolution—Aug 24th, 1914. (F. Harper.)

Allotype—Topotypic.

Paratypes—2 ♂♂, 3 ♀♀, topotypic; 1 ♀, Island at mouth of Rocker River, Aug. 16th, 1914. (F. Harper.)

The variation in the length of the subcostal vein gave me the impression at first that I had two distinct species to deal with. Its nearest ally appears to be *D. distans* O. S., but the subcostal cross-vein is less remote from the apex of the subcostal vein.

THE 1914 RECORD OF CATOCALÆ AND OTHER LEPIDOPTERA.

BY R. R. ROWLEY AND L. BERRY, LOUISIANA, MO.

(Continued from page 307.)

On the 17th took a *nebulosa*, a female *subnata*, *cara* and others. As the 18th was cool, "Catos" were few and mostly high on the trees.

July 19th—In the woods with George Dulaney and Lowell Pinkerton. Took one *viduata*, six *lacrymosa* (one of these was a *paulina*), *habilis*, *neogama*, one *nebulosa*, *palæogama*, two *piatrix*, the first of the season, *cara* and other moths. Temperature 90°. No "Catos" in the hollows, and not plentiful on the hillside. They were resting both high and low.

July 20th was close and warm, above 90°. Took nine *lacrymosa*, four *viduata* and the first *vidua* of the season, *retecta*, *habilis*, *neogama*, *palæogama* and ragged specimens of *junctura*.

The 21st was cloudy and drizzling all day. Took one *lacrymosa*, one *nebulosa*, four *cara*, five *viduata*, five female *retecta*, one *flebilis*, and saw other species taken on the 20th. The moths were under leaves and bark and usually high in the trees. George Dulaney accompanied the senior author on both the 20th and 21st.

The temperature of the 24th was over 100°. Found every tree trunk, stump and hole in the bank full of Catocalæ. Drove them up the branch in a perfect swarm. Saw *cara*, *nebulosa*,

neogama, *vidua*, *palæogama*, *retecta* and *innubens* in numbers. They flew from the roots and tree trunks by the scores. Took ten *viduata*, and saw many more. Moths were very scary and hard to take, flying at our approach. Everything was at the bases of the trees and flew low. Even *viduata* flew from tree to tree, which is unusual, as they fly from side to side of the same tree, and all were within one and a half feet of the tree bases, and several were seen on other than white oak. Took three *vidua*, and saw more. Saw many *habilis*, and took one *lacrymosa*.

Compared with the 19th, 20th and 21st July, there were ten Catocalæ on the 24th to one, and they were in the hollow and on the hillside alike. Never saw so many Catocalæ in one day before.

On the 25th the senior author visited "Catocala hollow" in the forenoon, starting at seven and returning at noon. Found the hollow and hillsides full of moths, fully as plentiful as on the 24th. Saw a number of *nebulosa*, taking two. Saw a very large red moth with front wings lighter than those of *cara*. It looked larger than any other "Cato" the senior author ever saw. It was probably *amatrix*. One *nebulosa* that escaped the collector was larger than *cara*. On the hillside took ten *viduata* and seven *vidua*, three *lacrymosa*, and saw specimens of other species in abundance. The moths were at the base of every tree and very numerous. *Retecta* was everywhere and *palæogama* by the hundreds. A few "Catos" were three or four feet above the tree bases, and all were wary as on the 24th, although the days were very unlike, the 24th being sunny and the 25th close, cloudy and threatening rain. *Vidua* was on almost all kinds of trees, white and black oak, sugar maple and hickory. *Lacrymosa* was usually on black oak, *palæogama* and *retecta* everywhere. *Viduata* almost always on white oak. *Habilis* everywhere

On the 20th of July observed a *Limenitis astyanax* ovipositing on wild crab. An egg that was taken home hatched on the 25th of July and the young larva readily fed on apple. It pupated Aug. 16th, and gave an imago August 21st

July 27th, p.m., thermometer above 100°. Catocalæ as plentiful as on previous days. Along the hollow, took four fine *nebulosa*, four *cara*, four *lacrymosa*. On the hillside took seven *viduata*, three *vidua*, and saw many *habilis*, *ilia*, *palæogama* and

neogama. Took a beautiful variety of *palæogama* with much white on the wings. Moths both high and low on the trees, but mostly low. Took three *viduata* on the body of the same white oak. Of the seven specimens of this species taken on this date, five were on white oak, and two on hickory. *Nebulosa* has the habit of flying before you and alighting on dry leaves, the ground or grass, apparently spurning concealment. At rest it is usually found under leaning tree trunks, or logs above the ground. Not very difficult to take after alighting.

The last collecting trip in July was on the 29th and the temperature was under 90°. The party consisted of the senior author, John Degroodt and Misses Gertrude Wallace and Charline Parks. We took eleven *viduata*, two *vidua*, six *lacrymosa*, three *phalanga*, one *nebulosa*, one *junctura*, and the first *angusi* of the season. Moths were not so plentiful as when the temperature was higher. Of the *lacrymosa* specimens two were *paulina* and one *evelina*. The last *viduata* taken on this date was resting on shag-bark hickory, and was a brand new female, the first female of the entire season, and the sixty-second taken in the past 23 days. The two *paulina* specimens and that of *evelina* were also females. The first *viduata* was taken on the 6th of July and the first *lacrymosa*, a female, on July 12th.

At 7.30, August 1st, the thermometer registered 80°. At 1.30 p.m. 90°. In a five-hours tramp did not see 25 Catocalæ, and they were high on the trees. Hard to account for this decrease in the number of moths. Took three *vidua* and one *lacrymosa*. Did not see a single *viduata*.

August 3rd, p.m., 90°; clear, with a slight breeze. There were some Catocalæ both in the valley and on the hillside. Everything scary. Took five *viduata*, but three of them were battered specimens, one *nebulosa* with bad hind wings, one ragged female *junctura*. Saw a few *residua*, *retecta*, *vidua* and more of *habilis* and *palæogama*. Nearly everything ragged. Saw a *lucetta* and a few wily *lacrymosa*.

Aug. 6th—Temperature 95° and threatening rain. Catocalæ fairly abundant both in the valley and on the hillside. Took a fair *nebulosa* and a battered *junctura*, an immense but ragged *cara*, eight *viduata*, but three were unfit for cabinet purposes and all were males, four male *lacrymosa*, one *lucetta* and one *angusi*. Saw

numbers of *neogama*, *vidua*, *palæogama*, *habilis*, *residua*, *retecta*, and a few *innubens*, all ragged. Moths were mostly at the bottom of the tree trunks. Everything hard to approach.

August 8th, 95°—dry. Catocalæ fairly common, but out of date. No new species. Took five *viduata*. Two were ragged and one was a female, the second of the year. Captured three fine *vidua*, one *lacrymosa*, two *habilis*, one *phalanga*, one *flebilis* one *lucetta*. The last two were somewhat damaged. Took a brand-new *neogama* and a new *cara*.

Aug. 12th—Warm, clear, woods dry and bare. No water in the creek. Catocalæ not numerous. Took three *viduata*, four *lacrymosa*, six *vidua*, *retecta*, *habilis*. Saw *neogama*, *palæogama*, *innubens* one *nebulosa*, *cara*, *residua* and *angusi*.

Aug. 14th—Imagos of *Callidryas eubule*, *Terias lisa* and *Nathalis iola* fairly common.

Aug. 15th—The sun rose with the thermometer at 56°. Temperature warmed up to 90° by mid-afternoon. Saw few Catocalæ in the woods. Took one *viduata*, one *lacrymosa* and one *neogama*. Saw a number of *lacrymosa*, but everything was scary and went "sky-high" when approached.

On August 19th Miss Gertrude Wallace took a fine fresh *piatrix* on a window screen.

August 26th—66° at 7 a.m., 82° at noon. Up "Catocala hollow" in the afternoon and in three hours saw but 29 moths, three *habilis*, two *retecta*, one *innubens*, two *neogama*, and the rest *vidua*. Moths high on the trees and on the sunny side.

The senior author did not see a single specimen of *Catocala robinsoni* in 1914, and this is the more surprising, as moths of that species were so plentiful in August and September, 1913.

Aug. 30th—Temperature nearly 90°. In the woods in the afternoon found moths few, and none of those taken were even passable specimens. Captured one *lacrymosa*, one *neogama*, three *habilis*, two *vidua* and one *scintillans*.

Sept. 6th—Saw a few *vidua* one *neogama*, and one *lacrymosa*.

Sept. 19th—Saw two *vidua* and one *palæogama*, but all were ragged.

On Oct. 5th and 11th took five new specimens of *Junonia*

cænia, Colias eurytheme, Pyrameis cardui and *huntera, Danais archippus.*

This Catocala record for 1914 is remarkable for the abundance of *viduata* and *lacrymosa*, species usually rare; the over-abundance of *amica, palæogama, retecta, neogama*, and *residua*, always fairly common; the re-appearance of *serena* not reported from here since 1901; the presence of *subnata*, never more than rare here; the appearance in increased numbers of those splendid species, *junctura, nebulosa* and *dejecta;* the falling off in the numbers of *angusi* and its variety, *lucetta, vidua, cara* and *amatrix;* in the entire absence of *robinsoni* fairly common here, *parta* and *cerogama*, always rare.

Of the earlier moths, *ilia* and *polygama* were common as usual, *grynea* and *insolabilis* much rarer than usual, *ultronia* more abundant than ever seen here before, *clintoni* and *minuta* fairly common, and both rare here of late years, *innubens* and its variety, *scintillans*, common as usual; *illecta* always common, *flebilis* always rare, *habilis* unusually numerous and *epione* in greater numbers than ever known here before. No *coccinata, judith* nor *consors* reported in this year. *Whitneyi* was added to our fauna for the first time this season.

Mr. Ernst Schwarz and other St. Louis collectors report the taking of *titania;* E. A. Dodge found *luciana, somnus, parta* and *meskei* fairly common in Nebraska in late July and August. Mrs. O. F. Hiser found *coccinata* common about Nevada, Iowa, in the early summer; Perry Glick and A. L. Porter took hundreds of Catocalæ at Hamilton, Mo., in late July, and Miss Pattie Hutchinson gathered data for the study of the 1915 crop of Texas Catocalæ.

Eggs of *Catocala coccinata* began hatching on the 29th of April. The young larvæ were dark, cross-banded by smoky brown and dirty green. Head black, small. Took readily to bur-oak leaves. On May 3rd the larvæ were one-fourth of an inch long, gray with cross-bands of black. Head small, black. Larvæ very active, like those of *ilia*. On the 8th of May larvæ over half an inch long, brownish gray, indistinctly striped longitudinally. A line of small mid-lateral black dots. True legs black, head small, dark colour. A slight hump over the third pair of prolegs.

May 17th—Larvæ one and one-fourth inches long, light gray, with yellowish tubercles in small dark basal patches. Both true

and prolegs gray. A sublateral row of short setæ. A rather strong mid-dorsal, blunt tubercle over the third pair of prolegs. A rather strong double tubercular ridge over the 8th abdominal segment. Head flattened in front, gray with yellow, *cara*-like spots at upper lobes (of the head), bounded outside by a black dash.

May 20th—Larvæ just after moult, one and one-half inches long, light bluish gray with light brown tubercles and light brown prolegs and cross-dorsal patches on the 5th and 8th abdominal segments, of the same colour. Head dished in front with light brown lobes above, and outer bounding black dash. A strong tubercle on dorsum of 5th abdominal segment and a pair of lesser tubercles on dorsum of the 8th abdominal segment. All three of these tubercles are brown, the one on the 5th with whitish tip. True legs gray. Sublateral row of short setæ. Prolegs rather long.

May 23rd—Larvæ full grown, two and two and one-fourth inches long, ashen (the exact colour of the gray branches of bur oak). The strong tubercle over the 5th abdominal segment, the pair of strong tubercles over the 8th abdominal segment and the roughness of body, due to the other tubercles, give a strong case of mimicry (like the knotty twigs of bur oak).

The general body tubercles yellow-brown, as also the dorsal pair over the 8th abdominal segment, but the latter are set on a bifid ashen ridge. The tip of the tubercle over the 5th abdominal segment has the body colour, but a little lighter at the tip. Enclosing and extending downward to the ventral surface from the 5th abdominal dorsal tubercle is an irregular band of brown and a similar patch either side of the 8th abdominal dorsal ridge.

A sublateral row of short setæ. Head as in *cara*, bifid above with lighter lobes flanked outside by a black dash. Ventral side pole pink with strong central black spots. There is a slight white patch either side of the first abdominal segment.

Larvæ began spinning May 27th. Just before spinning the larvæ evacuate a bright red fluid.

The first imago was on June 17th. Pupal period, 15 to 18 days.

Catocala lacrymosa.

Eggs of this species hatched on the 8th and 9th of May, and the larvæ were very small, slender, dirty-green, indistinctly lined longitudinally. Head small, dark green. Had grown little up to the 14th. Were feeding on pecan leaves. May 16th, larvæ small, light and striped longitudinally. Head small and light brown. Some of the larvæ moulted for the first time on this date, or eight days from hatching. May 20th—Larvæ at second moult one-third of an inch long, steel-gray, lined longitudinally with white. Head gray and striped. May 24th—Larvæ two-thirds of an inch long, light gray with double elongate dorsal black lunules on the first, second and indistinctly on the third abdominal segments. Head a little darker than the body.

May 31st—Larvæ nearly an inch long, light ashen gray, streaked with broken dark lines longitudinally. A pair each of black spot-like markings over the first and second abdominal segments. True and prolegs whitish. Head coloured as the rest of the body. No stigmatal band and no row of sublateral setæ. Ventral side of body whitish with large black spots. At this date most of the larvæ had succumbed to the excessive heat.

June 19th—The last and only larva left from a hundred that hatched on the 8th and 9th of May passed its third moult. Feeding on pecan. June 26th—Larva passed 4th moult, was over one and one-half inches long, light bluish gray, traversed longitudinally by fine lines of black dots. Head lighter than body colour, with brown longitudinal markings. A short lateral mouth dash of black. Tubercles white, sometimes in black basal patches. True and prolegs light gray. Head shaped as in other black-winged hickory feeders, large. Row of short sparse lateral setæ. No humps. July 3rd—Larva about one and three-fourths inches long, light bluish gray, with fine longitudinal streaks, white tubercles, lateral row of short sparse setæ. Short black streaks about the bases of the tubercles. Underside of body lighter than above, a little greenish and with brown median spots. No humps. Head as in other black under-wings. July 7th—Larva passed 5th moult, and was about two inches long, light bluish-gray with white tubercles. Head large, round and of body colour, with brown lines or streaks

and with a curved black streak on each side of the dorsal part of the head, reaching from the first thoracic segment nearly half the head length. Either side of the mouth is a short, black curved line. Both true and prolegs body colour. No hump.

June 9th—The larva died this morning, two months from hatching. The larval life of this species is either unusually long or pecan is not its proper food plant. A number of the hickory feeders are of slow growth.

NOTES ON A COLLECTION OF ORTHOPTERA FROM PRINCE EDWARD ISLAND AND THE MAGDALEN ISLANDS, QUE.

BY E. M. WALKER, TORONTO.

Through the kindness of Mr. James A. G. Rehn, of Philadelphia, I had the privilege recently of examining a small collection of Orthoptera taken by Mr. Bayard Long on Prince Edward Island, the Magdalen Islands, and certain other localities in Eastern Quebec and New Brunswick. The specimens from Prince Edward Island and New Brunswick were collected during the summer of 1912, those from the other Quebec localities during 1910.

The collection is of interest mainly on account of the localities, Prince Edward Island and the Magdalens having been hitherto quite unknown from an orthopterological standpoint. Only 14 species are represented among the 256 specimens in the collection, and although this small number is probably far short of the total number of species that inhabit these regions, it is doubtless indicative of a restricted boreal fauna, all of the species being well-known inhabitants of the Canadian Zone and most of them of wide distribution in the latter.

The most interesting features of the collection are the occurrence of an extremely large form of *Melanoplus extremus* Walk. in the Magdalen Islands and of the typical race of *Podisma glacialis* Scudd. in Prince Edward Island and Quebec, this race not having been definitely recorded before from Canada, though from its occurrence in Northern New England it was to be expected here.

The following is a list of the localities and dates of capture as given on the labels:—

PRINCE EDWARD ISLAND.

Bloomfield, August 7.
Brackley Point, August 31.
Bunbury, August 28.
Cape Aylesbury, August 29.
Charlottetown, September 1.
Douglas, August 26.
Dundee, August 26.
Lake Verde, August 9.
Malpeque, August 29.
Mt. Stewart, July 30.
Souris, July 28, August 24.
Southport, August 9.
St. Andrews, August 26.
Summerside, August 7.
Tignish, August 6.
Tracadie, August 31.
West River, Bothwell, August 24.

NEW BRUNSWICK.

Moncton, September 4.
Point du Chene, August 11.

QUEBEC.

Bic, July 14–27.
Cacouna, July 26.
Father Point, July 21.
Glin House, July 10.
St Fabien, July 23.

MAGDALEN ISLANDS, QUE.

Alright Island, August 21.
Basin Island.
Coffin Island, August 17.
Grindstone Island, August 23.
Grosse Island, August 16.
Wolfe Island, August 21.

LIST OF SPECIES.

Chorthippus curtipennis (Harris).—Bloomfield, 1 ♂, 2 ♀; Bunbury, 4 ♂, 4 ♀; Charlottetown, 1 ♂, 2 ♀; Dundee, 4 ♂, 1 ♀ (1 ♂, juv.); Souris, 1 ♂, 2 ♀; Southport, 1 ♂, 1 ♀; St. Andrews, 1 ♀; Tignish, 1 ♂; West River, Bothwell, 1 ♂, 3 ♀; Moncton, 2 ♀; Bic, 2 ♂, 4 ♀; Cacouna, (dry roadside), 1 ♂; Alright Island, 7 ♂, 5 ♀ (1 ♂, juv.); Coffin Island, 1 ♂; Grindstone Island, 2 ♂, ♀; Grosse Island, 2 ♂.

The series shows the usual amount of variation in colour-

pattern and length of tegnium, though all the species from the Magdalen Islands are brachypterous. One of the females from Bloomfield, a macropterous individual, is strikingly marked, the antennæ, dorsum of head and pronotum being rose-red, the face and lateral lobes of the pronotum grass-green and the tegmina and femora tinged with pinkish.

Mecostethus lineatus (Scudd.)—Bloomfield, 2♂; Bunbury, 1 ♂, 1 ♀; Charlottetown, 1 ♂ (juv.); Tracadie, 1 ♀ (on sphagnum bog); Alright Island, 1♂.

The two males from Bloomfield are less distinctly marked than usual, the pale costal streak of the tegmina being less distinct, the dorsum of the head and the entire pronotum concolorous, without pale lines along the lateral carinæ.

Mecostethus gracilis (Scudd.)—Dundee, 1 ♂.

Camnula peelucida (Scudd.)—Charlottetown, 1♂, 2♀; Dundee, 1 ♂, 1 ♀; Lake Verde, 1 ♀; Mt. Stewart, 1 ♂; Souris, 1 ♂; Tignish, 1 ♀; West R., Bothwell, 1 ♂; Bic, 10 ♂, 16 ♀; Father Pt., 2 ♂, 2 ♀; Glin House, 1 ♂, 2 ♀; Coffin Island, 1 ♀ (juv.); Grindstone Island, 4 ♂, 1 ♀ (♀ juv).

The labels of the Bic specimens bear the following notes: "Dry shaly shore and rocks at head of Ha Ha Bay," "dry shaly fields near Cap Gurgé," "dry rocks" and "dry grassy rocky fields." The specimens from Father Point are labelled "Rocky shores of St. Lawrence River."

Dissosteira carolina (L.)—Point du Chene (2 ♂, juv.)

Circotettix verruculatus (Kirby)—Moncton, 1 ♂; Bic, P. Q., 6 ♂

The Bic specimens are labelled as occurring on "dry exposures," "dry rocky clearing" and "dry grassy limestone exposures."

These specimens are rather pale, resembling *D. carolina*, though one example is rather dark and mottled. The Moncton specimen is almost black

Podisma glacialis glacialis (Scudd.)—Dundee, "east on P.E.I. Ry. toward Douglas," 1 ♀ ("black spruce swamp"). St. Fabien, 1 ♂ ("bog east of Lac de St. Fabien").

These specimens are quite typical, showing no variation toward the race *canadensis* E. Walk.

Melanoplus fasciatus (Barnston-Walk.)—Dundee, 2 ♂, 2 ♀; West River, Bothwell, 1 ♂; Wolfe Island, 1 ♂; Alright Island,

near the Narrows, 4 ♂, 3 ♀; Coffin Island, 1 ♂, 4 ♀; Grosse Island, 1 ♀.

The only macropterous individual is a female from Alright Island, in which the tegmina extend slightly beyond the apices of the hind femora. In the other specimens from the Magdalen Islands the tegmina reach about the end of the abdomen in the males and in one of the females; in the others they are somewhat shorter. The specimens from this group of islands are large, and are, for the most part, dark and heavily banded. Six characteristic specimens (3 ♂, 3 ♀) from Alright Island measure as follows:—

MALES.

Length of Body	Length of Tegmina	Length of Hind Femora
23 mm.	14 mm.	12.5 mm.
19 mm.	11 mm.	11.5 mm.
20 mm.	12 mm.	11.8 mm.

FEMALES

Length of Body	Length of Tegmina	Length of Hind Femora
24.5 mm.	6.5 mm.	12.5 mm.
26.0 mm.	14.0 mm.	12.5 mm.
28.5 mm.	19.5 mm.	13.5 mm.

The female from Grosse Island bears a marked resemblance to *M. altitudinum* in the large size, nearly uniform speckling of the tegmina and broken piceous band on the lateral lobes of the pronotum.

Melanoplus extremus Walk.—Souris, 2 ♂; Southport, 1 ♀; Bic, (July 14 and 27), 1 ♂, 1 ♀; Basin Island, 2 ♂, 2 ♀; Coffin Island, 1 ♂, 3 ♀; Grindstone Island, 3 ♂, 2 ♀; Wolfe Island, 2 ♂.

The specimens from the Magdalen Islands are remarkable for their extremely large size, while those from Bic and Prince Edward Island are rather small.

The following measurements show the range in size of the specimens in this series:—

MALES.

Locality	Length of Body	Length of Tegmina	Length of Hind Femora
Basin Is.	21.0 mm.	14.5 mm.	12.5 mm.
Basin Is.	24.0 mm.	16.0 mm.	13.5 mm.
Coffin Is.	24.0 mm.	16.0 mm.	14.0 mm.
Grindstone Is.	22.0 mm.	14.5 mm.	12.0 mm.
Grindstone Is.	22.0 mm.	14.0 mm.	13.0 mm.
Souris, P. E. I.	16.0 mm.	10.0 mm.	10.5 mm.
Souris, P. E. I.	16.0 mm.	14.7 mm.	10.0 mm

FEMALES

Locality	Length of Body	Length of Tegmina	Length of Hind Femora
Alright Is.	28.0 mm.	16.0 mm.	15.0 mm.
Basin Is.	25.5 mm.	15.5 mm.	14.0 mm.
Basin Is.	28.0 mm.	16.7 mm.	15.0 mm.
Coffin Is.	26.0 mm.	15.0 mm.	14.0 mm.
Coffin Is.	28.4 mm.	17.0 mm.	15.0 mm.
Grindstone Is.	27.0 mm.	15.0 mm.	14.5 mm.
Grindstone Is.	27.0 mm.	18.0 mm.	15.0 mm.

One of the males from Souris and the female from Bic are macropterous, the others are all brachypterous.

The large specimens from the Magdalens have the appearance of quite a different insect from the typical *extremus*, but differ from the latter only in size.

Melanoplus femur-rubrum (De Geer).—Bunbury, 2 ♂, 3 ♀; Malpeque, 1 ♀; Moncton, 1 ♂, 4 ♀.

Melanoplus atlanis (Riley).— Cape Aylesbury (sand dunes), 4 ♂, 5 ♀; Charlottetown, 1 ♂, 1 ♀; Douglas, 1 ♂, 1 ♀; Dundee, 5 ♂, 4 ♀; Lake Verde, 2 ♂, 1 ♀; Mt, Stewart. 1 ♀; Souris, 2 ♂, 2 ♀; Southport, 1 ♂; West River, Bothwell, 1 ♂, 3 ♀; Tignish, 2 ♂, 2 ♀; Moncton, 1 ♂, 1 ♀; Bic, 3 ♂, 1 ♀; Cacouna, 1 ♀; Father Point, 1 ♂, 1 ♀; Coffin Island, 1 ♂, 3 ♀.

The series is on the whole of typical size and appearance. The pair from Moncton are small and the series from the sand dunes at Cape Aylesbury are rather small and pale, as is usual in specimens from such stations. The specimens from Father Point were taken with *C. pellucida* from the "rocky shores of the St. Lawrence River."

Melanoplus bivittatus Say.—Bloomfield, 1 ♂; Bunbury, 2 ♂; Cape Aylesbury (sand dunes), 1 ♂; Charlottetown, 3 ♂, 2 ♀; Douglas, 1 ♂; Dundee, 2 ♂, 1 ♀; Malpeque, 1 ♂, 1 ♀; Souris (Basel Pond), 9 ♂, 2 ♀; Southport, 3 ♀; St. Andrew's, 2 ♂, 1 ♀; Summerside, 1 ♀; Tignish, 1 ♂, 1 ♀; West River, Bothwell, 2 ♂, 1 ♀; Moncton, 1 ♀.

All the specimens have red hind tibiæ. In the Prince Edward Island series the dark streak on the dorsal half of the outer side of the hind femora is heavy and conspicuous, the pale streaks in the lateral canthi of the pronotum are indistinct, while those on the tegmina are faint or absent. One of the males from Dundee is very small, measuring as follows: Length of body, 20 mm.; length of tegmina, 16 mm.; length of hind femora, 12.5 mm.

Conocephalus fasciatus (Say.)—(= *Xiphidion fasciatum*)—Moncton, 1 ♂.

Gryllus pennsylvanicus Burm.—Brackley Point, (boggy clearing), 1 ♂; Charlottetown, 1 ♂, 1 ♀; Dundee, 1 ♀.

A REMARKABLE MONOPHLEBINE COCCID FROM THE PHILIPPINE ISLANDS.

BY T. D. A. COCKERELL, BOULDER, COLORADO.

A few months ago Prof. C. F. Baker sent me a box of Philippine insects, among which I was surprised to see a male Monophlebid, remarkable for having the costal area of the wings broadly bright red. This feature has long been known to occur in a species, *Monophlebus raddoni* Westwood, from the Gold Coast, W. Africa. The Philippine insect is readily known from the African one by the longer caudal appendages.

Llaveia sanguinea, n. sp.

Male.—Length about 5 mm.; length of wings about 7; antennæ rather thick, middle joints with three whorls of long reddish hairs; eyes dark red, strongly facetted, very prominent, on stout stalks, like a young mushroom; behind each eye is a prominent shining red tubercle; anterior part of thorax dull black, forming a lobe extending over head; posteriorly to this the thorax is shining black, with a broad transverse bracket-shaped reddish-ochreous band; abdomen broad, red, with six long fleshy processes, all much more than half as long as breadth of abdomen, the terminal ones longest, but not very much so; penis long, with a very large raspberry-pink knob; legs red, hairy; wings ample, black with the two hyaline lines as usual, but the extreme base, and the costal region very broadly to within about 1.75 mm. of apex, very bright red.

Hab.—P. Princesa, Palawan, Philippine Is. (Baker 3878.)

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POPULAR AND ECONOMIC ENTOMOLOGY.

Insect Friends and Foes of Agriculture.*

BY LAWSON CAESAR, GUELPH, ONT.

Every farmer is forced to come in contact with his insect foes, and, therefore, knows something about them, but very few farmers know that there is a large number of insects that are not foes at all, but are friends. We shall, therefore, discuss these friends first.

Insect Friends.

The first class of friends we shall treat of is composed of those insects which aid agriculture by acting as pollenizers of plants. Almost everyone knows that before a plant can produce a fruit or seed some of the pollen must first be placed on the sticky tip of the pistil. This act fertilizes the plant and is called "pollination." In this work honey bees are the most important insect agents, but bumble bees and numerous other wild bees help greatly, as do also wasps, various kinds of flies, moths, butterflies and many other insects. Many of the lower kinds of plants, or plants with inconspicuous flowers, are pollinated in other ways, such as by the wind, but nearly all plants with conspicuous bloom require the aid of insects for proper and full fertilization. What would happen if we had none of this class of insect friends? We should not have more than one apple, or pear, or plum, or peach or any of our other much loved fruit to the one hundred or more we now enjoy. Moreover, there would be practically no fields of tomatoes, peas or beans, or of several other crops that are so necessary to us as foods.

The second class of insect friends consists of those insects that supply us with food, either directly or indirectly, through serving as food for the fish and birds that we use as food. Many tons of honey are produced in every country by the honey bee. A large part of the food of fresh-water fishes consists of the water insects

*An address delivered before the School for Rural Leadership.

that live about the shores of the lakes and rivers that these fish frequent. Even the larvæ of the troublesome mosquito serve in this way a useful purpose. Both domesticated and wild fowl feed to a great extent upon insects, the latter especially during the nesting season. So without taking time to go more into details we see that many insects may be friends in this important matter of providing food for us.

A third manner in which insects may act as our friends is as scavengers. If all the dead animals and plants, including trees, of course, were to lie undestroyed on the surface of the earth, they would soon make an intolerable condition of affairs. But in the summer no sooner does an animal or plant die than there gather to it various insects that quickly hasten the process of decay. Some of the insects that feed on dead animals are carrion beetles, rove beetles, blow-flies and flesh-flies. Any one who has watched how quickly a dead horse or smaller animal becomes a seething mass of insect life will readily understand why it has been said that a blow-fly can destroy a dead ox as quickly as a lion.

In the case of trees we have all seen beautiful pines that have been cut down or fallen and allowed to lie for a year or two in the forest, and then, when they are examined, are found to be perforated in numerous places by borers. These borers are the larvæ of certain kinds of beetles, chiefly long-horned beetles. We feel disappointed at the injury to the tree, but in nature the insects while feeding themselves on the wood are at the same time serving a useful purpose, because these holes allow the more rapid and deep entrance of diseases and so hasten greatly the rate of disintegration of the tree. We see, therefore, that insects help us greatly by removing dead animals and plants, and thereby giving back to the earth the substances of which they are composed and at the same time making room for other animals and plants to take their place.

The fourth way in which insects serve as friends is by many useful kinds helping to control injurious kinds. One class of insect that helps in this way is known as parasites, and another as predaceous insects. The latter merely capture their victims and feed on them as a lion would capture and devour a smaller animal, but the former kind pass all their larval stage either in or

attached to their victims, finally killing them. There are many kinds of parasitic insects, some, the Tachina Flies, resembling very closely house-flies; others, the Ichneumon-flies, Chalcis-flies, etc., resembling wasps. Some of the Ichneumon-flies are quite large and sometimes have a very long ovipositor or egg-laying apparatus, while the Chalcis-flies and Proctotrupids may be extremely small, so small in fact, that one can scarcely see them with the naked eye. Some of these very small parasites attack insect eggs, laying their own eggs in these. A single tiny egg is large enough to supply all the nourishment necessary to carry one of these little creatures through all its stages to maturity. Some parasites lay their eggs on the back of their hosts, but many lay them inside the body. A few species deposit not eggs, but living maggots upon or near the victims. The larvæ of a parasite does not, as a rule, kill the thing it feeds upon until it is itself full grown and ready to transform into an adult.

How useful parasites are can be seen when we remember the severe outbreak of the Army Worm last summer. Towards the end of this outbreak examination in the field showed that there was scarcely one of these caterpillars that was not parasitized. This year I have seen only one Army Worm. Now, the parasites may not be the only cause of the disappearance of this pest, but they are certainly one of the great causes and probably the chief one.

There are many useful predaceous insects, but I shall mention only two: namely, Ladybird beetles and Syrphus-fly larvæ. Everyone knows the pretty little Ladybird beetles with their hemispherical shape and often brilliant colours. The larvæ of these look like little alligators and are just as fond of destroying other insects as are the adults. Syrphus-fly adults usually resemble small bees or wasps, but they have only two wings. They may often be seen feeding upon flowers or hovering above them. Their larvæ are legless, taper towards one end and are stout and usually grayish or brown in colour. The Ladybird beetles and the Syrphus-fly larvæ are the two most helpful insects we have in the control of aphids or plant lice. Without their aid it would often be almost impossible to save our crops from these prolific and very destructive little pests. This is, however, only a single il-

lustration of many that could be used to show the good predaceous insects do.

The more one studies insects and thinks over what takes place, the more inclined he is to feel that were it not for our insect friends our insect foes would make this earth almost or quite uninhabitable for man. I do not mean, however, that insects are the only forces at work in controlling our foes, because disease also plays a great part, as do also extremes of heat and cold and several other things.

We must pass on now to consider briefly our insect foes.

Insect Foes.

There is no doubt that injurious insects every year take a large toll from farmers and especially from fruitgrowers. As there is not time to discuss many of these insects, we shall devote our attention first to our worst two orchard insects, and then to a few of the chief pests of the field crops.

There are many insects that attack fruit trees, but two of these stand out prominently for their powers of destruction. These are the San José Scale and the Codling Moth. The former is the most destructive insect pest ever introduced into the province, but fortunately, though it has been here for twenty years, it has not spread beyond the south-western counties. It is a very small insect, circular, and when full grown, has about the same diameter as the head of a pin. Its powers of reproduction are wonderful: from a single female there may be more than a million offspring by the end of the year. As all of these attach themselves to the trunk, branches, twigs, leaves or fruit and suck the juices, they soon do a great deal of harm. Any orchard that becomes infested with this pest in the warmer parts of the Province, and is not sprayed, is doomed to complete destruction in a few years, even the largest apple trees being killed. An exception to this statement should be made in the case of sour cherries and to some extent of Kieffer pears, the former being immune and the latter not often severely attacked. Up to the present time there have been only a few parasites attacking this scale in Ontario, but we are hopeful that these will become abundant in a few years. We have endeavoured to hasten the process by introducing parasites from Pennsylvania, where they are doing much good. In the meantime

there is a very satisfactory remedy against the insect, and no man who uses it intelligently need lose a single tree or have his fruit discoloured and rendered unsaleable by the scale. Even the worst infested orchards, provided the trees are not too nearly dead, can be taken in hand and brought back into perfect condition. Fortunately, the spraying necessary for this pest kills several others also, and is very valuable against certain diseases of fruit trees.

The Codling Moth does no injury to the trees themselves, but attacks the fruit of the apple and pear. It is the insect that causes the apple to be wormy. It is found all over the province and in unsprayed or poorly sprayed orchards does a great deal of harm. In the warm part of the province, where there is a larger percentage of a second brood, the amount of injury to the fruit varies f om 40% to 90%. In the colder portions it is less and runs from about 5% to 50%.

We can easily see, therefore, that the growing of clean apples is by no means an easy job. The fact is that insects and fungus diseases make it impossible to grow apples successfully on a commercial scale without spraying. It is, however, most gratifying to know that thorough spraying at the right time and with the right mixtures (see the Spray Calendar) not only completely controls these two insects, but practically all other orchard insects and diseases; so that in an average year it is not uncommon to find orchards in any of the fruit districts where over 95% of the fruit is free from insect injuries or fungus diseases.

We shall not devote further attention to orchard insect pests, but pass on to a brief discussion of the common insects of field crops.

The chief insects attacking such crops are grasshoppers, cutworms (including the army worm), wireworms and white grubs. These are familiar insects to almost every one. Each kind is capable of doing an enormous amount of injury, the amount depending partly upon the weather conditions. For grasshoppers we have at last in the so-called "Kansas Remedy" found a most satisfactory and cheap remedy, so that no crop need be severely injured by these insects if the owner uses this treatment. The same remedy, sometimes, however, with slight modifications, will usually prove quite satisfactory against cutworms and army worms.

It is interesting to know that attacks from grasshoppers, wireworms, white grubs and often from cutworms, too, can be prevented by simply following the practices of good up-to-date farming in which a short rotation of crops with fall ploughing and thorough preparation of the soil before seeding play a very important part. This is a great source of encouragement to the man who is trying to do his best. A short rotation of crops means that there will be no old pasture fields on the farm. These are the favourite breeding places of grasshoppers, wireworms and white grubs. It is a rare thing to find serious outbreaks of these pests on farms where no old pasture fields exist. Again, a short rotation of crops means that the insects in any particular field are deprived of their special food and either have to starve or seek this food elsewhere, often failing to reach it; for instance, wireworms and white grubs attack grasses and such cereals as wheat, oats and barley, but seldom do any injury to peas or clover; hence a short rotation of crops in which clover or peas play a part will help to starve them out. Good farming, moreover, means careful preparation of the soil for the seed and the selection of good plump seed, with the natural result that the plants will be more vigorous and thus better able to withstand the attacks of insects than weaker plants on poorly farmed land. An illustration of this is seen in the case of the Hessian fly. This insect delights in attacking weak or unthrifty wheat plants. I have counted as many as 1000 of the pupæ in a single square yard in a poor field of wheat. It is not at all uncommon to see two fields close together, one scarcely at all injured by the Hessian fly and the other severely injured; the chief reason for the difference being the better seed and condition of the soil in the former. I am not speaking now of the value of late sowing to prevent Hessian fly attack, though this is often very helpful. My aim has been to show that the better a man farms, whether he knows anything about insects or not, the less injury will be done by these to his field crops.

It is impossible to go into this subject now in fuller detail, but, in conclusion, it may be well to say that we should never get into a panic about insects and fear that some day some new and terrible pest will come to our country that will do incredible damage. New pests are not arriving so frequently as most people think,

and even if some do come, there is very little fear that methods of controlling them will not be found. Many of the insects that are thought to be new have been here for years, but have seldom been noticed because of the controlling influences mentioned above.

A NEW FLY OF THE FAMILY PHORIDÆ FROM CALIFORNIA.

BY T. D. A. COCKERELL, BOULDER, COL.

When recently (August, 1915) at La Jolla, California, I captured on the grounds of the Scripps Institution for Biological Research a Phorid fly remarkable for its relatively large size, and interesting to me on account of the armature of its legs, which recalled one of the fossil species from Florrissant. The species is new, and may be called:

Dohrniphora gaudialis, n. sp.

♀—Length about 4 mm., wings over 3.5 mm.; dull black, the front and thorax above anteriorly somewhat polished; third antennal joint ferruginous, blackened above; palpi clear bright red, the spines strong and black; wings pale greenish, the heavy veins sepia; trochanters and immediately adjacent parts pale reddish; knees reddened; anterior tibiæ pale dull ochreous, and middle ones brownish in front; tarsi dusky brownish; extreme apex of abdomen light ferruginous. Head small; proboscis stout, longer than head; arista long, minutely plumose; front with the usual strong bristles, directed backward; ocellar region scarcely elevated; four scutellar bristles, the posterior ones longest; halteres black; wings with the two heavy veins running closely parallel, with a narrow interval between them, the second one (third vein of authors) minutely branched before the apex, which is about half way from base to apex of wing; costa bristly; first thin vein (fourth of authors) gently and evenly curved, not bent, failing at extreme base; third thin vein failing at end, but fourth reaching margin; hind femora high and flattened; anterior tibiæ with a bristle on inner anterior face at about end of first third, and a row of minute black setæ on apical half; middle tibiæ with two very long bristles on basal part,

and several apical ones; the middle tibiæ also have two black lines consisting of minute setæ, one running the length of the tibia, the other only reaching middle, when it is interrupted by a shining patch of about ten rows of minute setæ, arranged transversely, comb-like; hind tibiæ very minutely hairy, but with no large bristles except the long apical spur, and a series of four small black apical spine-like bristles, the only other armature being on the anterior side, the end of which is fringed with minute black spinules, while just above is a weak patch of about four transverse rows of setæ, like those on mid-tibiæ; basitarsi on inner or anterior side with very well developed transverse rows of setæ.

This is readily known from the other described American species by its large size and the armature of the legs. On account of the transverse rows of setulæ on the legs it resembles *Phora multiseriata* Aldrich and *Phora laminarum* Brues, the latter being a Miocene fossil. I have ascertained that the middle tibiæ of *P. laminarum* have a pair of long bristles on the basal part, exactly as on the insect now described. In the characters of the venation and the armature of the scutellum *P. multiseriata* is quite distinct from *D. gaudialis*, but the fossil species has four scutellar bristles, as in the La Jolla one. Thus it appears that our insect is actually more nearly related to a Florissant fossil than to any living species.

The specific name is derived from the name of the locality.

JEAN HENRI FABRE

A few days before the present issue of our magazine went to press, a telegram from Orange, France, appeared in the daily papers announcing the death on Oct. 11, 1915, of Jean Henri Fabre, one of the greatest entomological observers the world has ever known. Owing to his extremely secluded life, his intense aversion to publicity in any form, and his dislike of human society, it is only within recent years that Fabre's genius has been generally recognized, and among English speaking nations this recognition has been largely due to the publication of English translations of certain selections from his "Souvenirs Entomologiques," and to Miall's translation of Legro's beautiful work "Fabre, Poet of Science."

A more extended notice of Fabre's life and work will appear in our December number. An appreciative account of his writings by Prof. Wm. Lockhead was published in the 45th Annual Report of the Entomological Society of Ontario (1914).

A NEW DIASTROPHUS ON STRAWBERRY.

BY WILLIAM BEUTENMULLER, NEW YORK, N. Y.

Diastrophus fragariæ, n. sp.

Head jet black, face rufous and coarsely rugose, vertex and cheeks smooth and very highly polished. Antennæ 14-jointed, basal joints rufous, the following joints gradually becoming darker. Thorax jet black, smooth and highly polished, collar rugose, pleuræ somewhat shining. Parpsidal grooves broad and well defined, continuous and rather widely separated at the scutellum. Lateral grooves indistinct and scarcely perceptible. Median groove wanting. Scutellum coarsely rugose, obtusely pointed at the tip, foveæ at base shining and close together. Abdomen pitchy black, microscopically punctate, petiole rufous. Legs yellowish brown, claws black. Wings hyaline, ciliate, radial area closed, cubitus continuous, cross-veins heavy, all veins dark brown. Length, 2 mm.

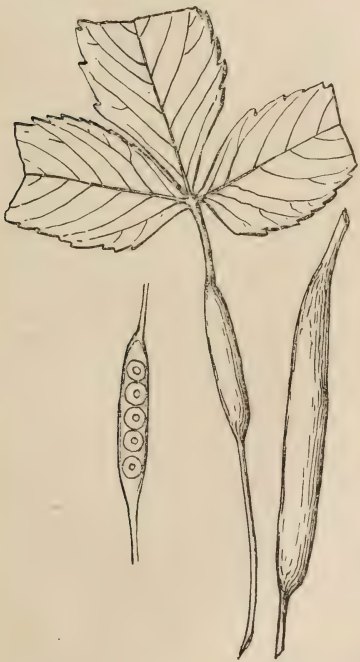


Fig. 29. *Diastrophus fragariæ* Beutm., galls on petioles of strawberry.

Gall—On the petiole of Strawberry: Polythalamous, elongate cylindrical swelling tapering at each end. Red and villose like the rest of the petiole. The internal structure is spongy and

contains a single row of 5-20 larval chambers. Length from about 25 to 50 mm. Width 3-5 mm.

Habitat—Toronto, Canada (A. Cosens).

The gall of this species has long been known. Saunders mentions it in his "Insects Injurious to Fruits," 1887, p. 331, and calls it the Strawberry Leaf-Stem Gall. Prof. S. A. Forbes also mentions the gall in the 22nd Report of the State Entomologist of Illinois, 1883 (1884), p. 97. H. F. Bassett speaks of a Cynipidous gall occasionally seen on the petiole of strawberry leaves (Trans. Am. Ent. Soc., Vol. XXVI, 1900, p. 325). Mr. L. H. Weld found the galls at Ithaca, New York and Evanston, Illinois and I found the same in the vicinity of New York City for some years past. In August, 1913, Mr. A. Cosens collected the gall on wild strawberry in Toronto, Canada. He transplanted some of the infested plants into pots and managed to mature the galls from which he reared five males, being the first one to succeed in obtaining the flies.

The illustration is from a sketch made by Mr. Weld and redrawn by Mrs. E. L. Beutenmuller.

NOTES ON THE STRAWBERRY LEAF PETIOLE GALL (*DIASTROPHUS FRAGARIÆ* BEUTM.)

BY A. COSENS, PH.D., TORONTO, ONT.

A cylindrical enlargement of the leaf petiole of *Fragaria virginiana* Duch. constitutes the gall. It has a somewhat segmented appearance owing to the separation of each larval cell from the adjoining one by a shallow annular constriction. The surface is usually coloured a rich reddish brown and bears a pubescence, varying with that of the petiole from which the gall originates. The species from which the producers were obtained was glabrous.

Length 10-50 mm. Diam. 3 mm.

In comparison with *Diastrophus fusiformans* Ashmead on *Potentilla monspeliensis* var. *norvegica* (L) Rydb. this species differs in the following particulars: The arrangement of its

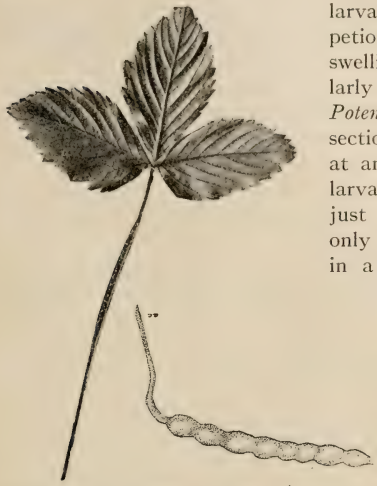


Fig. 30. Galls of *Diastrophus fragariæ* Beutm. Upper figure, an immature gall; lower figure, gall from which the producers emerged. (Natural size.)

larval cells in a row, along the petiole, produces a symmetrical swelling quite unlike the irregularly nodular deformity of the *Potentilla* gall. While a cross section of this latter species, at any level, will show several larval cells in the stem pith, just inside the ring of wood, only one will of necessity be cut in a similar section from the strawberry gall.

As the infected leaves wither prematurely, it is difficult to find the mature galls, although the young specimens are quite noticeable. The producers were secured by transplanting host plants so that they could be kept under observation. The galls were removed after the leaves had withered, and were kept on earth, out of doors, during the winter. The producers emerged from May 12-14.

DESCRIPTIONS OF NEW SPECIES OF IPIDÆ (COLEOPTERA).*

BY J. M. SWAINE, ENTOMOLOGICAL BRANCH, DEPARTMENT OF AGRICULTURE, OTTAWA.

Ips knausi, n. sp.—A large elongate species, length 5.8 mm., width 2.1 mm.; the sides parallel, thickly clothed with long light hairs in front, on the sides and behind. Allied to *emarginatus* Lec., but distinct in the punctuation of the discal interspaces of the elytra, and the characters of the declivity.

Description of the male: The *head* has the front densely

*Contribution from the Entomological Branch, Department of Apiculture, Ottawa.
November, 1915.

granulate-punctate, rather densely hairy, with a wide, shallow, transverse impression between the eyes, and a shining median space towards the vertex; the eyes oblique, very narrow, and broadly emarginate in front; the antennal scape sparsely hairy without, the club wide, marked with three distinct, bisinuate sutures which are densely fringed with long bristle-like hairs; as broadly rounded at the tip as at the base, rather densely punctured below.

The *pronotum* is very slightly longer than wide, 10:9; with the base very broadly rounded; the hind angles broadly rounded; the sides slightly arcuately narrowed or nearly parallel for over two-thirds their length, then obliquely narrowed and slightly bisinuate in front; rounded on the front margin; the asperities of the cephalic half of varying size, the largest more or less concentrically arranged; the caudal half coarsely, closely and deeply, but not roughly punctured; thickly clothed with long hairs in front and about the sides.

The *scutellum* is minute, elongate, faintly channelled and shining.

The *elytra* are parallel for the greater part of the length, then rounded to the strongly produced, dehiscent and submucronate tip; densely clothed with long light hairs about the sides and around the margin of the declivity; with the elytral striæ distinctly impressed, narrow, with deeply impressed, closely placed punctures of median size; the sutural striæ a little more strongly impressed than the others, strongly divergent and widened behind; the interspaces very wide, not distinctly convex, except the first two, which are also more strongly granulate near the declivity; *the wide interspaces all confusedly punctured*, more sparsely on the disc towards the base, very densely and roughly on the sides and about the declivity; the declivity oblique, deeply concave, with the tip strongly produced; the first tooth, on the second interspace, acute, distinct and preceded by a row of granules; the third interspace with a row of granules at the top of the declivity; the second tooth, on the fourth interspace, large, conical, acute, adjacent but not united to the third; the third tooth very long, wide, compressed, with the sides parallel and the tip deeply emarginate, representing the united teeth of the 5th and 6th interspaces; the fourth tooth smaller than the second, conical, blunt, nearer to the third than

to the acute apical margin; the declivital margin, viewed from the side, straight and vertical from the base of the third tooth to the base of the acute apical margin; the acute apical margin elongated towards the tip so that the apex of the declivity becomes subacuminate, and the edge with two deep emarginations on each side; the depth of the declivity closely punctured and dull from numerous minute wrinklings of the chitin, the punctures bearing short, slender hairs throughout. The pubescence is long, light and prominent about the side and margin of the declivity.

The venter is densely punctured and clothed with long hairs.

This species was obtained through the kindness of Mr. W. Knaus. The type bears the labels, Cloudcroft, 9000 f., N. M., W. Knaus, 8-8-03, 197.

Ips perroti, n. sp.—Description of the type, a male: A slender species, dark reddish-brown in all my specimens; length 4 mm., width 1½ mm., relative proportions, length of pronotum 29, length of elytra 46 ,width of pronotum behind 27, width of elytra in front 26, width of elytra behind 28.

The *head* has the front convex, somewhat flattened in front, rather closely punctured, more coarsely and roughly towards the eyes, sparsely granulate on the disc, more densely towards the epistoma, with a short, blunt median tubercle on the epistoma, and a row of smaller blunt tubercles along the epistomal margin; the disc rather sparsely clothed with slender hairs, and the epistoma densely fringed as usual; the genæ moderately closely and deeply punctured; the eyes with a very broad, shallow emargination in front; the antennal club with the first two sutures slightly bisinuate, at the middle, strongly bent distad at the sides.

The *pronotum* is slightly longer than the width, with the caudal margin strongly rounded; the sides nearly straight and parallel for two-thirds the length, rather strongly narrowed on the distal third and rounded in front; rather densely hairy on the sides and in front, glabrous on the disc; irregularly, not very coarsely asperate in front; smooth and shining behind and finely sparsely punctured, very finely towards the middle line and much more coarsely towards the sides; the median smooth space nearly obsolete, more distinct and somewhat impressed at the middle of the disc.

The *elytra* are one-half longer than the pronotum; a little narrower at the base than the pronotum, very slightly wider behind; the sides nearly parallel for about four-fifths the length, then rounded to the declivity, which is steep and truncate as viewed from above, with the tips dehiscent and slightly tuberculate; the elytral striæ regular, distinctly, but slightly, impressed on the disc, except the sutural striæ, which are much wider and deeper than the others and widened behind; the lateral striæ not impressed; the strial punctures rather small and closely placed, more closely on the first two and the lateral striæ; the first interspace convex, finely granulate near the declivity; the second convex, faintly granulate near the declivity; the remaining discal interspaces flat; all the discal striæ uniseriately punctured throughout their length, closely towards the declivity, very sparsely towards the base; the lateral interspaces more closely punctured, uniseriately above, confused near the lateral margin, with the punctures nearly as coarse as those of the striæ; the *declivity* very abrupt, deeply concave, not closely punctured, more coarsely than the disc; the suture elevated, and smooth on the lower two-thirds; the margin strongly elevated and armed with four teeth on each side; the tooth of the second interspace well developed, acute, recurved, preceded by a few minute granules; that of the third obsolete, or represented by the largest of a row of small granules; those of the fourth and fifth interspaces united at the base, the connecting ridge nearly vertical; the tooth of the fourth interspace acute, recurved; that of the fifth stout, capitate, acute-pointed; the fourth tooth conical, in the type occupying nearly all the short space between the raised apical margin and the third tooth; the raised apical margin wide, moderately produced and entire; the pubescence of the elytra long, erect, fine, rather dense on sides below and about the declivity; the discal pubescence fine and sparse.

The *female type* differs from the above only by the less strongly developed epistomal armature, and the different declivital teeth. The teeth are all acute and less strongly developed than in the male; the second and third teeth are similar in shape, conical, united at the base and but little larger than the first and fourth.

Labels with the male type: I. Perrot, Que. 1912; ♂ 218; ♂ type. Labels with the female type: I. Perrot, Que. 1912, ♀ 218; ♀ type. Host of type series *Pinus resinosa*.

Variations: The pubescence is somewhat abraded on the disc of the elytra in the type; and in some specimens the interstrial punctures of the disc are more numerous; the third discal interspace is frequently impunctate on the basal two-thirds; the frontal tubercle varies greatly in size, being nearly obsolete in some females; the strial punctures of the elytra vary considerably in size; the length varies from 3.5 mm. to 4.25 mm.

This species differs from *tridens*, *borealis*, and *interruptus* by the characters of the front which lie between the much sparser granulation of one sex of *borealis* and the extremely dense granulation of *interruptus;* from *borealis* in the longer, much more finely punctured pronotum, more sparsely punctured elytral interspaces and distinctly much more strongly developed declivital armature; from *interruptus* in the usually much smaller size and more slender form, finer and sparser pronotal punctuation, the much more abrupt declivity with strongly marked sexual variation, and the fewer and smaller granules on the first and second interspaces.

Dryocoetes sechelti, n. sp.— A very small species, with a subcircular, strongly convex pronotum, coarse elytral punctures and a flattened declivity. Length 2.1 mm.; comparative measurements: Pronotum, length 9, width 9; Elytra, length 15, width 9.

The head is more deeply embedded in the pronotum than usual; with the front convex, rather coarsely, closely granulate-punctate, with erect hairs from the punctures; the median carina narrow but distinctly elevated and shining, from epistoma to vertex; the epistomal fringe dense, longer and bright yellow on the middle third; the eyes wide, coarsely granulate and rather broadly emarginate in front; the antennal club much longer than the funicle; the pedicel as long as the outer four segments; the last segment as wide as the last four are long and the second very narrow; the club nearly as wide as long; with the distal densely pubescent part projecting strongly beyond the truncate tip of the basal corneous part which covers about four-fifths of the under surface, and is bounded distally by a distally convex suture, the distal fifth densely pubescent, the basal corneous part with a few

long hairs irregularly placed; the upper surface with the basal half corneous with the distal margin nearly straight, sparsely hairy, the distal half densely pubescent, obliquely subtruncate, with two sutures, the first of which is straight, and the second arcuate.

The pronotum is subcircular, as wide as long, rather strongly produced over the head, very broadly arcuate behind, strongly arcuate on the sides and in front, very strongly convex with the summit slightly behind the centre; very densely, rather finely and somewhat regularly asperate in front of the summit and on the sides behind, coarsely and densely granulate-punctate on the disc behind with the asperities there reduced to granules on the margin of the punctures; the pubescence rather thick and erect, longer in front and on the sides.

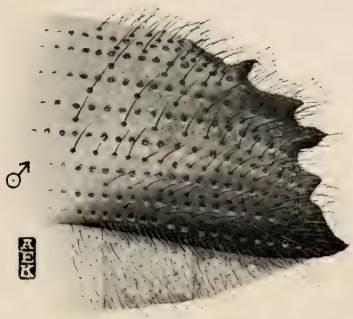
The elytra are as wide as the pronotum, the sides parallel well beyond the middle, then moderately arcuately narrowed and broadly subtruncate behind as viewed from above; the sutural striæ wide and rather strongly impressed, the remaining discal striæ slightly impressed, the last three on the sides strongly impressed; the strial punctures coarse, deep, subquadrate, and very densely placed; the interspaces a little convex, very little wider than the striæ, closely, deeply uniseriately punctured, the punctures deep, but much smaller than those of the striæ, a little coarser on the sides than on the disc; the declivity very steep, flattened from above, with the suture elevated, the sutural striæ strongly impressed, the second striæ distinctly impressed; the strial punctures as coarse as on the disc, the interspaces uniseriately granulate-punctate; rather thickly clothed with erect greyish-pubescence of moderate length. The venter is closely, coarsely, and roughly punctured.

There is no apparent sexual difference in our specimens, but the front is usually entirely retracted.

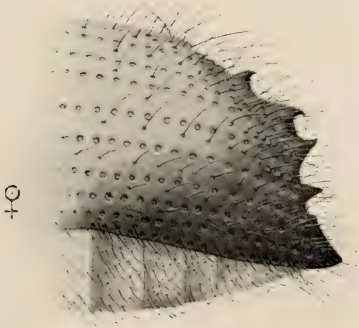
The pronotal asperities are sometimes coarser than in the type and always very dense; the elytral striæ from the second outward are in some hardly perceptibly impressed on the disc, although distinctly impressed in the type.

Type locality: Sechelt, B. C., Canada; Type number, 2170.

Dryocoetes pseudotsugae, n. sp.—Description of the *female type:* Length 4.7 mm.; width 1.5 mm.; reddish-brown (not



IPS PERROTI, N. SP.; SIDE VIEW OF THE DECLIVITY OF THE MALE. ENLARGED. ORIGINAL.



IPS PERROTI, N. SP.; SIDE VIEW OF THE DECLIVITY OF THE FEMALE. ENLARGED. ORIGINAL.

fully chitinized); closely allied to *septentrionis*, but distinct in the confused small punctures of the interspaces, and the more flattened elytral declivity.

The front is as in *septentrionis;* but more densely granulate and hairy, with the postepistomal smooth space and median pit, and finely carinate above. The *pronotum* is as in *septentrionis*, but usually more densely punctured and more strongly granulate behind on the sides; the median carina narrow, distinct behind. The elytra are much as in *septentrionis;* but much more broadly rounded behind and with the declivity very distinctly flattened when viewed from above, though not so strongly as in *confusus* Swaine and *betulæ* Hopk.; with the striæ only lightly and narrowly impressed on the disc; the sutural striæ rather strongly impressed on the basal third; the strial punctures small and moderately deep; the interspaces wide and flat; the interstrial punctures smaller than those of the striæ and rather numerous, uniseriate on the 1st, 2nd and 4th interspaces, on the 3rd and 5th and the outer interspaces confused with usually smaller additional punctures; the declivity shining, distinctly flattened with the first two striæ distinctly impressed, the 2nd interspace impressed at the tip, the interspaces on the declivity uniseriately very finely and rather closely granulate-punctate in both sexes.

The *male* has the front very wide, nearly as hairy as in the female, with the median area at the base of the epistoma widely impressed and shining.

Variations: The size is fairly constant, as represented in our collection, the length varying from 4 mm. to 4.8 mm. The most important variation is in the interstrial punctuation. The first, second and fourth discal interstriæ are usually uniseriately punctured but often variably confused towards the base and declivity, the other interspaces are usually decidedly confusedly punctured from the base to the top of the declivity with punctures of large and smaller size.

It is apparently a good species, distinct from *septentrionis* by its flattened declivity and confused interstrial punctures.

It is very abundant on the coast of British Columbia in the bark of Douglas fir, and probably occurs also in other conifers. We have specimens from as far north as Inverness and Queen Charlotte Islands.

Type labels: Stanley Park, Vanc.; Douglas fir; 2639.

Phloeosinus pini, n. sp.—A small black species, with the front strongly carinate; the pronotum shining; the declivity without conspicuous sculpture; length 2.5 mm.; width 1.25 mm.

The *head* has the front flattened, densely, coarsely rugulose-punctate, with a fine, acute median carina on the cephalic half; the rugulose area extending backwards across the vertex as a roughly punctured area with its caudal margin converging from the eyes to the middle line on the occiput; the pubescence short, reddish, inconspicuous; the genæ densely punctulate with a few scattered moderate, finely setose punctures; the eyes narrowly emarginate, one-half divided; the antennal club nearly twice as long as wide, with the first two sutures moderately oblique, and with a well developed septum on the dorsal half, the third suture more strongly oblique and indistinct.

The *pronotum* is wider than long, 10.5:8; brightly polished; with the hind margin strongly bisinuate and obtusely angled at the middle; the sides very strongly arcuate on the caudal half, nearly straight on the caudal fourth, then strongly arcuately narrowed so as to be very strongly constricted behind the broadly rounded front margin, the constriction extending across the dorsum as an impression; the disc finely punctured, more densely behind, sparsely in front except along the front margin, coarsely punctured on the sides; the punctures finely granulate, more distinctly so on the sides and in front; the pubescence short and not very distinct; the median line very fine, smooth, more distinct along the middle third. A shallow, oblique impression extends latero-cephalad on the caudal half of the disc.

The *elytra* are wider than the pronotum, 12:10, stout, one-third longer than wide, 16:12 (at the base), one-twelfth wider behind than at the base; the front margins strongly arcuate and serrate, the serrations isolated on the sides; impressed about the minute scutellum; the hind margin, from above, broadly rounded; the striæ very narrow; the strial punctures indistinct, fine and separated; the interspaces very wide, the second interspace much wider at the base, causing the remaining discal striæ to be outcurved at the base; the interspaces slightly convex on the disc,

strongly convex on the sides; strongly rugulose-punctate, with larger transverse, subacute asperities intermixed with numerous smaller granules, the asperities numerous and dense towards the base, becoming uniserate towards and upon the declivity; the declivital interspaces moderately convex, closely, finely punctured and uniseriately moderately asperate; the second more finely, the third more coarsely and wider; the ninth subcarinate on the sides; the pubescence very short, reddish, stout, stouter and a little more evident on the declivity.

The *male* has the front with a similar rugulose-punctate area, but with the region between the eyes less densely though coarsely rugulose and rather strongly and broadly impressed, with a well developed acute median carina on the cephalic half, ending in a small concave median epistomal lobe as in the female; with an obtuse elevation on each side opposite the middle of the eyes; the pronotum a little more strongly constricted in front, with the sides nearly straight behind; the declivity similar to that of the female, except that the second interspace appears slightly flattened, with the asperities smaller than on the others, and the asperities on the third are less numerous and rather distinctly coarser than those on the first. This may be individual, or may indicate the sexual differences so distinct in other species.

I have taken it only in twigs of *Pinus divaricata*, in the Riding Mountains, Manitoba. The occurrence of *Phloeosinus* in Pinus is unusual. Type series number, 2008.

Phloeosinus utahensis, n. sp.—A large species; length 3⅛ mm., width 2 mm., colour black, with the elytra reddish.

The *head* has the front flattened in the female, densely coarsely rugose-punctate and rather densely clothed with short yellow hairs; with a faint, curved, transverse impression; the eyes narrowly, very deeply emarginate; the genæ rather densely, coarsely punctured; the antennal club elongate with the sutures oblique.

The *pronotum* is one-half wider than long, 16:11, widest behind, the hind margin bisinuate, the sides rounded and strongly narrowed towards the broadly rounded, reddish front margin, moderately constricted near the front with the constriction extending across the dorsum; finely, densely, deeply and evenly punctured

above, with the median carina very fine and nearly obsolete; the pubescence very short and indistinct.

The *elytra* are one-half longer than wide, 25:17.5; slightly wider than the pronotum; the base strongly arcuate, raised and serrate as usual with lunar asperities becoming acute and isolated on the sides; with the striæ narrow, deep, distinctly and closely punctured; the interspaces wide, granulate-punctate and asperate as usual, more densely and coarsely towards the base; the asperities becoming uniseriate behind; the first and third interspaces strongly raised on the declivity, and the asperities as a row of small teeth with granules intermixed; the second interspace convex but less strongly raised, closely punctured and with a row of very few and much smaller points; the reddish pubescence very short, abundant but indistinct, denser, more evident and scale-like on the declivity, with minute slender hairs from the asperate punctures.

The *male* has the front widely and deeply impressed with a median carina on the cephalic half; the pronotum very broadly arcuate on the caudal half, and very strongly narrowed in front, with the median line fine and slightly elevated; the elytra with the discal asperities very sparse, but on the declivity the first and third interspaces bear each a regular row of large, compressed, black-tipped teeth; those of the first interspace are strongly compressed, with the distal edge elongate, the anterior angle rounded, the posterior angle elevated and acute, situated on the lateral half of the interspace, the mesal half of which is smooth and finely punctured; those of the third interspace smaller and more numerous than those of the first; the second interspace as wide as on the disc, flat, finely punctured and entirely without asperities; the fifth, seventh and ninth interspaces each with a row of much smaller but very distinct serrations. The pubescence is slightly longer on the declivity and less scale-like.

One male and one female from Stockton, Utah, through the kindness of Mr. W. Knaus. These are probably sexes of the same species, and are distinct from Leconte's type of *serratus*. Type number, 2182.

Phloeosinus hoppingi, n. sp.—A very small species, with the alternate interspaces on the declivity strongly serrate. The length, 1.9 mm.; width, 1 mm.; the colour black, the basal margin

of the elytra, and the declivity reddish-brown, the antennæ and tarsi yellow.

The *head* has the front and vertex shining, moderately, not very closely, rather roughly punctured, rugosely on the sides; with a rather deep transverse arcuate impression and an acute well developed median carina between the impression and the epistomal margin; the pubescence short, erect, not conspicuous except the yellow dense epistomal fringe; the eyes deeply emarginate, the antennal club wide, six-tenths as wide as long, with the first two segments subequal in length and each nearly as long as the outer part, the first two sutures nearly transverse, the third strongly oblique, a strongly chitinized septum shown on the dorsal third of the first and second sutures.

The *pronotum* is wider than long, 6:5; with the hind margin bisinuate; the sides very strongly arcuate behind, strongly arcuately narrowed in front of the middle and bisinuate behind the broadly rounded front margin, widest near the hind margin; the disc rather coarsely, not densely, punctured, not distinctly granulate; the pubescence short, suberect, forming a conspicuous median line of hairs.

The *elytra* are one-third longer than wide, 13:10; the bases arcuate, elevated and serrate; the sides slightly wider at the middle; the striæ deep and moderately narrow; the strial punctures moderately small but distinct; the interspaces convex, closely coarsely granulate-punctuate, and coarsely uniseriately asperate on the disc near the suture and alternately on the declivity; the first interspace asperate only on the hinder half; the second asperate only on the basal half, more coarsely towards the base; the third asperate throughout, more coarsely towards the base; the fifth and seventh interspaces distinctly asperate on the hinder half; the declivity with the alternate interspaces more strongly convex and moderately, rather closely, acutely serrate; the 1st and 3rd punctured on the mesal side with the row of serrations along the outer side; the second interspace on the declivity hardly convex and narrower than the 1st and 3rd; the 9th carinate behind but hardly serrate; the pubescence fine but distinct, larger on the sides, closer and minutely scale-like on the declivity.

The *male* has the front rather coarsely roughly, closely punc-

tured, with the whole central portion broadly and deeply concave, but with the margins of the concavity rounded; the median carina well developed and acute extending from between the eyes to the nearly obsolete epistomal lobe; the pronotum is of the same relative length and width as in the female, but the sides are more nearly parallel behind and more strongly constricted in front; the elytral declivity with the serrations distinctly coarser, with the acute apices directed obliquely caudad.

Seven females and three males from California, received from Mr. Ralph Hopping; taken in "cedar limbs." Type number, 2171.

Phloeosinus vandykei, n. sp.—A small species, with rather sparsely punctured pronotum and deep narrow striæ. Length, 2.2 mm.; width, 1.2 mm.

Description of the *female:* The *head* has the front flattened, coarsely, deeply rather sparsely punctured and granulate; with a low acute median carina becoming prominent on the epistoma; the pubescence short, stiff and erect; the antennal club over half as wide as long, 7.5:11, with the first two segments comprising more than one-half the mass; the first two sutures obliquely arcuate, the third more strongly oblique; the septa strongly developed on the first two sutures.

The *pronotum* is wider than long, 5:4; with the base bisinuate; the sides broadly rounded on the hinder two-thirds, and narrowed towards the front; constricted behind the front margin, which is very broadly rounded; the disc rather coarsely, deeply, rather sparsely punctured, the punctures finely granulate; the pubescence fine; the median line very finely faintly carinate behind.

The *elytra* are 1.4 times as long as wide; the bases arcuate, elevated, and coarsely serrate with the lunar serrations becoming coarser, acute, isolated and strongly oblique on the side; the sides somewhat inflated behind; the hind margin broadly rounded as viewed from above; the striæ very narrow and deep, those of the disc outcurved towards the base; the strial punctures very small; the interspaces convex, sparsely rather coarsely asperate-punctate; the asperities uniseriate on the declivity, larger, confused and lunar towards the base, strongly oblique and finally longitudinal

towards and upon the sides at the base, moderately confused on the disc and sides except on the third, fifth, seventh and ninth, which are nearly uniseriate; the ninth interspace carinate; the second wider towards the base; the declivity with the first three sutures nearly equal, the first and third hardly elevated, the second not narrower and hardly impressed, but without asperities, the third uniting with the ninth, the fourth met on the declivity by the fifth, sixth, seventh and eighth; the asperities of the declivity uniseriate, fine and acute, and the surface of the interspaces there smoother and more shining than on the disc; the pubescence very fine, short and indistinct. The discal interspaces are frequently nearly uniseriately asperate; the asperities are reduced to fine granules on the sides.

The *male* has the front broadly and rather deeply concave; the pronotum more broadly rounded on the sides and more sharply constricted in front; and has the declivity smoother and more brightly polished, with the serrations nearly obsolete except for a few sparse granules on the third interspace.

Type locality: Huckleberry Meadow, Fresno Co., Calif.

Received through the kindness of Mr. Ralph Hopping. It was taken in "Cedar limbs." Type number, 2173.

Hylastes ruber, n. sp.—Stouter than usual, the pronotum shorter and nearly as wide as the elytra; the elytra with the striae hardly impressed, narrow, the strial punctures small, the interspaces flat and densely, rather coarsely granulate; length, 4.8 mm.; width, 1.75 mm.

The *head* has the front strongly convex, the middle line evenly moderately convex from epistoma to vertex; closely, moderately, rather rugosely punctured; the transverse impression at the base of the beak very faintly indicated; the epistoma moderately impressed on each side; the median carina acute, fine but well developed, extending to the middle of the front; the epistomal lobe wide, concave at the middle with the sides somewhat tuberculate; the pubescence minute and inconspicuous, nearly obsolete.

The *pronotum* is but very slightly longer than wide; broadly rounded behind; the hind angles rounded; slightly arcuate on the

sides, subparallel for three-fourths the length, then strongly narrowed and rather distinctly constricted; the front margin moderately rounded; considerably narrower than the elytra; the punctures rather small and close on the disc, dense and somewhat rugose on the sides, smaller, closer and somewhat rugose in front; the smooth median line slightly elevated throughout, slightly widest at the middle; the pronotum not acutely margined on the sides behind.

The *elytra* are twice as wide as long; moderately wider than the pronotum, 13 to 10.5; the base truncate, acute; the humeral angles rounded; the sides subparallel for nearly three-fourths the length, then strongly arcuately narrowed and semicircularly rounded behind as viewed from above, with the side margin bisinuate behind; very narrowly rounded at the apex; the striæ very narrow and but faintly impressed upon the disc and sides; distinctly impressed on the declivity; the strial punctures small, not larger than those of the pronotum, closely placed, deep and bordered with black, of about the same size throughout; the interspaces flat upon the disc and sides, faintly convex behind on the disc and upon the declivity; densely, and rather coarsely granulate upon the disc, becoming finely asperate upon the declivity and confused throughout; the sides of the declivity impressed before the tip; the pubescence minute, reddish and moderately distinct upon the declivity; the basal third of the first three discal interspaces with the strial septa and interstrial transverse roughenings strongly oblique.

The venter has the last segment densely punctured, very broadly rounded behind, and moderately convex throughout: the prothorax below closely punctured and rugulose with the punctures more distinct than usual. There appears to be no sexual difference in the few specimens available; probably only one sex is represented.

This species is related to *macer* Lec., and differs in the distinctly stouter form; shorter and stouter pronotum, rugose on the sides and in front; and the striæ much less distinctly impressed.

Type number, 2310a.

The type is from Golden, B. C.; also taken in the Creighton Valley, B. C., in bark of dying Douglas fir.

DRYOCOETES PSEUDOTSUGAE, N. SP. GREATLY ENLARGED.
ORIGINAL.

Variations in our few examples are slight; the pronotum is arcuately subparallel on the sides for three-foutrhs the length or more and constricted before the front margin, widest at or before the middle; sometimes slightly more elongate than in the type.

The types of these species are in the collection of the Entomological Branch, Ottawa.

SOME OLD CLASSIFICATIONS OF INSECTS.

BY HARRY B. WEISS, NEW BRUNSWICK, N. J.

From the time of Aristotle to the present, different naturalists have advanced and advocated various systematic arrangements of insects. Many of the older ones were never generally adopted and only a few in part hold good at the present day. Linnaeus arranged insects in seven orders, but as entomologists became more exacting, the number was gradually increased until thirty-seven are now recognized as set forth in Brues and Melander's "Key to the Families of North American Insects."

It is not the purpose of this paper to deal with the history of the various changes which have taken place, but simply to set forth, as a matter of entomological interest, some of the systems which were proposed several hundreds of years back.

ARISTOTLE'S SYSTEM.

Aristotle (384-322 B.C.), Greek philosopher.

I. Winged insects (*Pterota* or *Ptilota*)
   1. With wing cases—beetles (*Coleoptera*)
   2. With coriaceous wings—grasshoppers (*Pedetica*)
   3. Without jaws— bugs (*Astomata*).
   4. With powdery wings—moths, butterflies (*Psychæ*).
   5. With four transparent wings (*Tetraptera*).
      Without stings and larger—(dragon-flies).
      With stings—bees and wasps (*Opisthocentra*).
   6. With two wings (*Diptera*).
      Without mouth-piercers and smaller—flies and crane-flies.
      With mouth-piercers—gnats and gad-flies (*Emprosthocentra*)

II. Wingless insects:
  1. Occasionally acquiring wings,
     Ants (*Myrmices*).
     Glow-worms (*Pygolampides*).
  2. Without wings (*Aptera*).

ALDROVANDI'S SYSTEM.

Aldrovandi, Ulissi (1522-1605), Italian naturalist, studied law and medicine, occupied chair of natural history in 1560 at University at Bologna.

I. Land insects (*Terrestria*):
  1. With feet (*Pedata*),
     a With wings (*Alata*).
        Without wing-cases (*Anelytra*).
        With membranaceous wings (*Membranacea*).
        Honey making ((*Favifica*).
        Not honey making (*Non favifica*).
        With scaly wings (*Farinosa*).
        With wing cases (*Elytrota*).
     b Without wings (*Aptera*).
        With few feet (*Paucipeda*).
        With many feet (*Multipeda*).
  2. Without feet (*Apoda*).

II. Water insects (*Aquatica*).
  1. With feet (*Pedata*).
     a With few feet (*Paucipeda*).
     b With many feet (*Multipeda*).
  2. Without feet (*Apoda*).

RAY AND WILLUGHBY'S SYSTEM.

Ray, John (1628-1705), sometimes called the father of English natural history. Willughby, Francis (1635-1672), English ornithologist and ichthyologist, was pupil, friend, patron and co-worker of John Ray.

I. Insects undergoing no transformations.
  1. Without feet.
     a Land insects, including worms (*Terrestria*).
     b Water insects, including leeches (*Aquatica*).

2. With feet (*Pedata*),
   a With six feet ((*Hexapoda*).
   Land insects (*Terrestria*).
   Larger, including lignivorous larvæ (*Majora*).
   Less, including lice and springtails (*Minora*).
   Water insects including the river shrimp (*Aquatica*).
   b With eight feet (*Octopoda*).
   With tails—scorpions (*Caudata*).
   Without tails—spiders, mites (*Non caudata*).
   c With fourteen feet—woodlice.
   d With twenty-four feet.
   e With thirty feet.
   f With many feet.
   a Land insects (*Terrestria*).
   With a roundish body—millipedes (*Tereti seu subrotundi*).
   With a flat or compressed body—centipedes (*Plano seu compressa*).
   b Water insects (*Aquatica*).
   With a round body (*Corpore tereti*).
   With a flat body (*Corpore plano*).
   With a double tail (*Bicaudatum*).

II. Insects undergoing transformations.
   1. Transformations instantaneous.
      a Lace-winged flies (*Libellæ seu Perlæ*).
      b Wild bugs (*Cimices sylvestres*).
      c Locusts and mantes (*Locustæ*).
      d Field crickets (*Grylli campestres*).
      e Hearth crickets (*Grylli domestici*).
      f Mole crickets (*Grylli talpa*).
      g Tree hoppers (*Cicadæ*).
      h Cockroaches (*Blattæ*).
      i Crane-flies (*Tipulæ*).
      k Water-scorpion (*Scorpius aquaticus*).
      l Water flies (*Muscæ aquaticæ*).
      m May-flies (*Hemerobii*).
      n Earwigs (*Forficula seu Auricularia*).
   2. Transformations twofold, metamorphosis duplex.
      a With wing-cases—beetles.

b Without wing-cases.
With mealy wings—butterflies and moths (*Alis farenaceis*).
With membranaceous wings—bees, flies (*Alis membranaceis*).
With two wings.
With four wings.
Gregarious (*Gregaria*).
Making honey—bees (*Mellifica*)
Not making honey (*Non mellifica*)
Solitary (*Solitaria*).
Bee-formed (*Apiformia*).
Wasp-formed (*Vespiformia*).
Butterfly-formed (*Papilioniformia*).
With an ovipositor (*Seticaudæ seu Triplia*).

SWAMMERDAM'S SYSTEM.

Swammerdam, Jan (1637-1680), Dutch naturalist.

I. Transformations immediate, the insects being hatched perfectly formed—fleas, spiders, etc.
II. Transformations taking place under a covering—locusts, crickets, bugs, dragon-flies, may-flies.
III. Transformations with a pupa-case intermediate—beetles, wasps, saw-flies, gnats.
Transformations in the pupa state obtected—moths, butterflies.
IV. Transformations in the pupa state coarctate—ichneumons, flies, etc.

VALLISNIERI'S SYSTEM.

Vallisnieri, Antonio (1661-1730), Italian entomologist.

Vallisnieri arranged insects into the four following groups: Plant insects, Water insects, Insects inhabiting earthy or mineral substances and Insects inhabiting living animals.

LINNAEUS' SYSTEM.

Linnaeus, Carl von Linné (1707-1778), Swedish botanist.

I. Winged insects:
  1. With four wings.
    a Upper wings more or less crustaceous, the under wings membranaceous.
      Upper wings quite crustaceous and not overlapping (*Coleoptera*).
      Upper wings semi-crustaceous and overlapping—bugs, grasshoppers (*Hemiptera*).
    b Upper and under wings of same texture.
      Wings covered with small tiled scales—butterflies and moths (*Lepidoptera*).
      Wings membranaceous and naked,
        Without a sting—dragon-flies, etc. (*Neuroptera*).
        With a sting—wasps, bees (*Hymenoptera*).
  2. With two wings—flies, gnats, etc. (*Diptera*).
II. Wingless insects (*Aptera*).

LAMARCK'S SYSTEM.

Lamarck, Jean Baptiste Pierre Antoine De Monet, Chevalier de (1744-1829), French naturalist.

I. Insects with jaws:
  1. With wing-cases—beetles (*Coleoptera*).
  2. With straight wings—crickets, etc. (*Orthoptera*).
  3. With four equal wings—dragon-flies (*Neuroptera.*)
II. Insects with jaws and a sort of sucker.
  4. With four unequal wings—bees, etc. (*Hymenoptera*).
III. Insects with no jaws but having a sucker.
  5. With powdery wings—moths, etc. (*Lepidoptera*).
  6. With upper wings of unequal consistence—bugs, etc. (*Hemiptera*).
  7. With two wings—flies, etc. (*Diptera*).
  8. Without wings (*Aptera*).

LATREILLE'S SYSTEM.

Latreille, Pierre Andre (1762-1833), French naturalist.

I. Insects with more than six feet and without wings (*Myriapoda*).
  1. With many jaws—woodlice (*Chilognatha*).
  2. With many feet—millipedes (*Chilopoda*).

II. Insects with six feet.

Without wings.

a With organs of motion like feet (*Thysanura*).
b Mouth with a retractile sucker (*Parasita*).
c External mouth with a jointed tube enclosing a sucker (*Suctoria*).

With four wings.

A Upper wings crustaceous or coriaceous, at least at the base.

a With under wings folded crosswise—beetles (*Coleoptera*).

1, Pentamera; 2, Heteromera; 3, Trimera; 4, Tetramera).

b With under wings folded lengthwise (*Orthoptera*).
Legs formed for running (*Cursoria*).
Legs formed for leaping (*Saltatoria*).

c With sucker enclosing several bristles (*Hemiptera*).
1, Heteroptera; 2, Homoptera.

Upper wings membranaceous.

a Wings naked and nettled (*Neuroptera*)—1, Subulicornes; 2, Planipennes; 3, Plicipennes.

b Wings naked and veined (*Hymenoptera*)—1, Terebrantia; 2, Aculeata.

c Wings with dust-like scales (*Lepidoptera*)—1, Diurna; 2, Crepuscularia; 3, Nocturna.

With two twisted elytra and two wings (*Rhipiptera*)—1, Xenos; 2, Stylops.

With two wings (*Diptera*).

Latreille also wrote a paper on the Geography of Insects in which he divided the globe into twelve insect zones. His two main divisions were Arctic (all north of the equator) and Antarctic (all south of the equator). The Arctic was sub-divided into the Polar, sub-Polar, Superior, Intermediate, Supra-tropical, Tropical and Equatorial, while the Antarctic embraced the Equatorial, Tropical, Supra-tropical, Intermediate and Superior.

HOME'S SYSTEM.

Home, Everard (1756-1832), English naturalist.

Metamorphogenoa—Having the embryo produced from an egg which is formed in the ovarium, subjected to transformation and breathing by air-tubes (spiracula); heart wanting, blood white.

1. The embryo developed from eggs attached under the tail —lobster (*Cancer*).
2. The embryo developed from eggs carried upon the anterior feet —spider (*Aranea*).
3. The embryo developed from eggs deposited under the cuticle of the skin or stomach—gadfly (*Œstrus*).
4. Embryos developed from eggs for several generations, impregnated at the same time—plant louse (*Aphis*).
5. Embryos produced from eggs of one mother that compose the whole republic—bee (*Apis*).
6. Embryos from eggs deposited under water—water moth (*Phryganea*).

The foregoing classifications are representative of what were known as the wing, locality, transformation, mouth and egg systems; those of Aristotle and Linnaeus being examples of the wing system, those of Swammerdam and Ray & Willughby of the transformation system, those of Aldrovandi and Vallisnieri and one of Latreille's the locality system, and that of Lamarck the cibarian or mouth system. Home's classification represents the egg system and the tabulated one of Latreille's was known at one time as the modern or eclectic system, being a combination of the principles of several of the preceding ones.

De Geer, Louis Gerhard, Baron (1818-1896) Swedish statesman and writer, was also the inventor of a wing system. Cuvier, Georges Leopold Chretien Frederic Dagobert, Baron (1769-1832), French naturalist, and Fabricius, Johann Christian (1745-1808), Danish entomologist and economist, both put forth systems based on mouth structures, while Clairville, J, whose writings were published between 1798 and 1806, Leach, William Elford, who

was at one time connected with the British Museum and died in 1836, and Stephens, James Francis (1792-1852), an English entomologist, were all advocates of the eclectic system and originators of classifications along such lines.

MacLeay, William Sharp, an English entomologist, who published between 1819 and 1838, was the author of what was known as the quinary system, in which insects were arranged in circular groups of fives, so placed as to bring those having the nearest resemblance, contiguous to one another in their several circles. By some authors, insects were also arranged according to the condition of their food, such as those feeding on living substances (*Thalerophaga*) and those feeding on dead substances (*Saprophaga*). These groups were subdivided, but such systems on the whole were never brought to any degree of perfection.

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FIFTY-SECOND ANNUAL MEETING OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO.

This was undoubtedly the most successful meeting of the Society that has ever taken place. It was held at Ottawa in the large laboratory of the Entomological Branch of the Department of Agriculture on Thursday and Friday, November 4 and 5, 1915, and the President, Dr. C. Gordon Hewitt, Dominion Entomologist, occupied the chair. Throughout the entire sessions the closest interest was evinced in the papers presented, most of which were of decided importance to farmers, horticulturists and others interested in agriculture and forestry. Valuable discussions followed the presentation of many of the papers. Entomologists from nearly every province in Canada were in attendance, as well as visitors from the United States. Among those who were present were Dr. H. T. Fernald, Amherst, Mass., who delivered the popular illustrated lecture on Thursday evening, November 4th, his subject being "Life Zones in Entomology and their Relation to Crops"; Mr. C. P. Lounsbury, Chief of the Division of Entomology of the Union Department of Agriculture, Pretoria, South Africa; Mr. A. F. Burgess, Melrose Highlands, Mass.; Rev. Thos. W Fyles, Ottawa; Prof. W. Lochhead, and Mr. E. M. Du Porte, Macdonald College, Que.; Rev. Father Leopold, and Prof. F. Letourneau, La Trappe, Que.; Prof. L. Caesar, Provincial Entomologist of Ontario; Prof. E. J. Zavitz, Provincial Forester, and A. W. Baker, Ontario Agricultural College, Guelph, Ont.; A. F. Winn, Westmount, Que.; J. C. Chapais, St. Denis en Bas, Que.; H. G. Crawford, Wilton Grove, Ont.; F. J. A. Morris, Peterboro, Ont.; C. MacNamara, Arnprior, Ont.; Prof. W. H. Brittain, Provincial Entomologist of Nova Scotia, Truro, N. S.; Mr. H. G. Payne, Kentville, N. S.; Sir James Grant, Ottawa; Dr. F. T. Torrance, Veterinary-Director-General; Dr. F. T. Shutt, Dominion Chemist; W. T. Macoun, Dominion Horticulturist; Dr. C. H. Higgins, Pathologist; F. W. L. Sladen, Apiarist of Dominion Experimental Farms; R. H. Campbell,

Director of Forestry; H. T. Gussow, Dominion Botanist; W. Ide, Private Secretary to the Minister, Dept. of Agriculture; D. Johnson, Dominion Fruit Commissioner. The following members of the Entomological Branch were present: Dr. Hewitt; Arthur Gibson, Chief Assistant Entomologist; J. M. Swaine, Assistant Entomologist for Forest Insects. Field Officers: R. C. Treherne, Agassiz, B. C.; G. E. Sanders, Annapolis Royal, N. S.; E. H. Strickland, Lethbridge, Alta.; G. Beaulieu, Ottawa; J. D. Tothill and L. S. McLaine, Fredericton, N. B.; Norman Criddle, Treesbank, Man.; W. A. Ross, Vineland, Ont.; C. E. Petch, Hemmingford, Que.; R. N. Chrystal, Vancouver, B. C.; J. R. Gareau, Strathroy, Ont.; A. E. Kellett, Artist Assistant; J. I. Beaulne, Inspector.

The following papers were presented:

"Insects of the Season in Ontario."

"Willow and Poplar Curculio."

—L. Caesar.

"Insects of St. Annes, Que., season of 1915."

"Occurrence of *Tychius picirostus* on clover at St. Anne's, Que."

—E. M. DuPorte.

"The Home of *Gortyna stramentosa*."

—A. F. Winn.

"Observations upon some of the Predaceous and Parasitic Hymenoptera."

—Rev. Thos. W. Fyles.

"The Leaf Weevil (*Polydrosus impressifrons* Gyll) in New York."

—P. J. Parrott and Hugh Glasgow.

"Side Worm Injury by the Codling Moth."

—E. P. Felt.

"*Lygus invitus* and its Control in 1915."

—W. Brittain

"A Capsid Attacking Apples."

—H. G. Crawford.

"The Founding of the Science of Cecidiology."

—A. Cosens.

"The Army Cutworm in Southern Alberta."
—E. H. Strickland.

"Some Notes on Nose and other Bot Flies."
—W. Lochhead.

"Further Notes on the Warble Fly, *Hypoderma bovis*."
—S. Hadwen

"Forest Insect Investigations in Canada"
—J M. Swaine.

"The Life History of *Chermes cooleyi* in Stanley Park, B. C."
R. N. Chrystal.

"The Cabbage Maggot (*Chortophila brassicæ*) in British Columbia" (a) Natural Methods of Control; (b) Autumn development.
—R C. Treherne.

"Fresh Woods and Pastures New."
—F. J. A. Morris.

"Some of the methods followed in Nova Scotia in Controlling the Brown-tail Moth."
—G. E. Sanders.

"Raising Brown-tail Moth Parasites at Melrose Laboratory for Distribution in Canada."
—L. S. McLaine.

"Locust Control Work with Poisoned Baits in Eastern Canada, 1915."
—Arthur Gibson.

"Apple Leaf Rollers In Ontario."
—L. Caesar.

In addition to the above, brief addresses were given by Dr. Hewitt, by Mr. Charles MacNamara on the Habits of *Thalessa*, and by Mr. J. D. Tothill on the colonization of the parasites of the Gipsy and Brown-tail Moths in eastern Canada. All of the papers presented at the meeting, as well as a full account of the discussion, will be published early in 1916 as the Forty-sixth Annual Report of the Entomological Society of Ontario.

The following were elected officers of the Society for 1915-16:

PRESIDENT—A. F. Winn, Westmount, Que.

VICE-PRESIDENT—Prof. L. Caesar, Ontario Agricultural College, Guelph, Ont.

SECRETARY-TREASURER—Mr. A. W. Baker, B.S.A., Lecturer in Entomology, O. A. College, Guelph, Ont.

CURATOR—Mr. G. J. Spencer, B.S.A., Demonstrator in Entomology, O. A. College, Guelph.

LIBRARIAN—Rev. Prof. C. J. S. Bethune, M.A., D.C.L., F.R.S.C., Professor of Entomology and Zoology, O. A. College, Guelph, Ont.

DIRECTORS—Division No. 1, Mr. Arthur Gibson, Entomological Branch, Department of Agriculture, Ottawa; No. 2, Mr. C. E. Grant, Orillia; Division No. 3, Dr. A. Cosens, Parkdale Collegiate Institute, Toronto; Division No. 4, Mr. C. W. Nash, Provincial Biologist, East Toronto; Division No. 5, Mr. F. J. A. Morris, Peterboro; Division No. 6, Mr. J. W. Noble, Essex, Ont.; Division No. 7, Mr. W. A. Ross, Vineland Station, Ont.

On Friday evening, November 5th, a very enjoyable smoker was held. The Entomological Section of the Ottawa Field Naturalists' Club were the hosts, and brief speeches, reminiscent, anecdotal and felicitous, enlivened the proceedings.

A. G.

A NEW TABANUS

BY C. P. WHITNEY, MILFORD, N. H.

Tabanus wrighti, n. sp.

Female—Length 11 mm. Face, front and palpi black. Antennæ black, the slightest rufous tinge at base of third joint, which is narrow, the upper angle rounded and hardly raised. Frontal callus round, a short, tapering prolongation above.

Sub-callus denuded, shining (an uncertain character). A prominent ocelligerous tubercle. Eyes (revived) black, four narrow green bands, the interspaces twice as wide. Thorax shining black. Abdomen black, sparsely pilose, segments with narrow

JEAN HENRI FABRE.

In his room and seated at the table where he wrote his "Souvenirs Entomologiques."
(Illustration reproduced from *"L'Illustration,"* to which paper grateful acknowledgments are made.)

posterior whitish bands. Second segment with a small dorso-lateral rufo-fulvous spot reaching posterior margin. Venter black, the whitish bands more distinct. Feet black. Wings dark fuliginous, fading at apex, hinder margin and root. First posterior cell widely open.

A paratype, slightly damaged, is a little larger and lacks the spots on second segment.

Taken in May, at West Palm Beach, Florida, by Dr. H. E. Wright, after whom the species is named.

JEAN-HENRI FABRE.

It is hard to believe as I write that Fabre is dead, for the great age to which he lived and the extraordinary character of the man had, as it were, dulled one's senses to the inexorable facts of life. The photograph before me of "that inimitable observer," as Darwin called him more than half a century ago, showing that keen old face wrinkled with years of the most intense and penetrating observation still intent on the movements of an insect, had instilled into one an idea of permanence. But on October 11th, at Orange, he finished a life of ninety-two years of hard and strenuous toil.

Born of humble parentage at Saint Léons, a little village in the Haute Rouergue, on December 22nd, 1823, he was destined to a life of poverty, through which he struggled with an indomitable perseverance, which was the outstanding characteristic of his entire life and the main cause of the imperishable fame that will be his. His early years were a perpetual struggle for education. Undeterred by disappointment, he laboured on as a teacher, now as a professor of mathematics and physics at Ajaccio in Corsica, where an acquaintance with that brilliant naturalist Moquin-Tandon was responsible for his determination to forswear mathematics for the study of living things, and later at Avignon, always careless of degrees and dignities. The chance discovery in 1854 of a volume of that famous entomologist, Léon Dufour, on the habits of a wasp, *Cerceris*, directed his steps into that path of patient entomological study from which, during the succeeding sixty years of incessant

labour, he never turned. In the following year there appeared in the *Annales des sciences naturelles* his memoir on *Cerceris*, which signalises the beginning of his entomological career. While at Avignon he met John Stuart Mill, whose love for botany furnished the basis of their remarkable friendship; incidentally he took his doctor's degree in Natural Sciences at Paris, and his discovery by Victor Drury, the Minister of Public Instruction, was responsible for his distinction as a Chevalier of the Legion of Honour. Little did these honours avail him, for during the twenty years during which he stayed at the University of Avignon his salary never changed from £64 per annum. Disappointed, but clinging more tenaciously than ever to his life's pursuit, he settled down near Orange, in the lower Rhone, and subsequently, "after forty years of desperate struggles," he found his Eden at Sérignan, a little village in Provence.

Here for the rest of his life he dwelt; his laboratory was a small tract of wild land "L'Harmas," a "living laboratory," where he studied "non l'insecte mort, macéré dans le trois-six, mais l'insecte vivant; un laboratoire ayant pour objet l'instinct, les moeurs, la manière de vivre, les travaux, les luttes, la propagation de ce petit monde, avec lequel l'agriculture et la philosophie doivent très serieusement compter."

The central feature of Fabre's work was that he studied the living insect and its behaviour, and in this fact lies the chief value of his contribution to entomological knowledge. Never since Réaumur has so wide a range of insects been studied so intensively as we find in the *Souvenirs entomologiques;* but while Réaumur described with the greatest precision the objects of his patient study, he did not enter into the lives of his insects and their instinctive behaviour to the extent that Fabre has accustomed us. And how different their respective lives: Fabre carrying on a perpetual struggle to raise a family in the face of poverty and Réaumur in ease and comfort. It is safe to say that no entomologist in the past has accomplished a work of so unique a character as that of Fabre, and it is unlikely that the future will hold another man who will equal his achievement. In 1878 he was able to assemble the results of about twenty-five years' labour in the form of the

first volume of the *Souvenirs*, and the ten volumes he has left us constitute his great contribution to our knowledge.

In an appreciation of this character it is impossible to refer individually to the two hundred and nineteen memoirs, as his chapters really are, in the *Souvenirs*, much less to select from the thousand and one inimitable word pictures he gives us, greatly as one is tempted to do so. As the years passed by, his literary style developed until it reached a beauty of description that cannot be excelled in any language, and to appreciate it fully one must go to the original memoirs, although the translations of the selected essays, which are gradually being published, will serve to bring his work to the attention of a wider audience than it has previously enjoyed.

Undoubtedly the outstanding feature of Fabre's work was his contribution to our knowledge of insect behaviour, as I have already stated. He was not content with mere observation, with anatomical or physiological studies, but searched deeply for the principles underlying the behaviour of the creatures with whom he lived hour by hour and day by day: endeavouring to obtain, as it were, the insect's point of view. He was constantly comparing insects with men, and this anthropocentric attitude, no doubt, was a source of danger. Nevertheless, the evidence he afforded as a result of his painstaking work of the "pervasive mentality and purposiveness," to use the words of a recent writer, is his main contribution to the interpretation of animal behaviour. His belief in instinct as a dominant and underivable factor fundamentally different from intelligence, his strong vitalistic conception of the organism, and his firm opposition to the ideas set forth by Darwin, with whom he corresponded and for whom he conceived a real affection, are leading characteristics of his work. Although he assailed the "vast and luminous balloon" of evolution, as he called it, his criticism lacked the constructive arguments one would have desired from a close observer, and his intense conviction of the fallacy of a mechanistic interpretation appears to have blinded him to the possibility of an alternative interpretation of facts consistent with the idea of evolution.

C. Gordon Hewitt.

POPULAR AND ECONOMIC ENTOMOLOGY.

The Centenary of Kirby and Spence's *"An Introduction to Entomology."*

BY F. J. A. MORRIS, PETERBOROUGH, ONT.

To fill the space, which has been kindly put at my service, may I remind our brother entomologists that the current year is the centenary of the first (and still the greatest) popular work in English on Insects? In 1815 was published the first volume of "An Introduction to Entomology," by William Kirby and William Spence.

It is no exaggeration to claim this work as effecting a revolution in Great Britain in the study of Natural History. As a science, Entomology had already had its foundations well and truly laid in the 17th century: in Europe, by masters like Malpighi, Swammerdam, Leeuwenhoek and Redi; in England, by Ray and Willughby. The bright examples of Reaumur and Linnaeus, Fabricius, Latreille and the Hubers, sufficed in the 18th century to keep the torch aflame, and reconcile a little band of devotees to labour unrewarded by public recognition, and often the butt of ridicule and obloquy. But no attempt was made, in English at least, to popularise the science.

The Rev. William Kirby, father of modern British Entomology, was a native of East Anglia. He began his work in Natural History as a botanist, and his name appears among the chartered members of the newly founded Linnean Society in 1788. He was at this time in his 30th year, but having one day found, in his rambles after plants, a very beautiful insect, he diverted his attention to this new branch of Natural History.

The first in the long list of his contributions to the Linnean Society is dated 1793; in 1802 appeared his important monograph on British Bees; in 1811 he established the Insect Order of *Strepsiptera*, which still holds good; and in 1812 (as a note in his commonplace book goes to show) he had identified what in his day was considered a bee-louse, the triungulin or young larva of the Oil-beetle.

December, 1915.

When 46, he met for the first time a young and enthusiastic collector of beetles, William Spence. The two became fast friends, and three years later was born the idea of a popular introduction to their favourite pursuit. This was in the year 1808, and it shows how great examples serve to

"inspire posterity,
Fathering their kind, from son to son;"

for it was in 1808 that news had come to them of the death of the great Fabricius.

The "Introduction" consists of a series of letters written in delightful style, the more remarkable that both authors were learned in every branch of the science and profoundly read. They brought to their task the ripe experience of years of active observation and collection, and during nearly 20 years of planning and publishing, they ransacked whole libraries of British and foreign literature.

The letters were originally in four volumes: Vol. I dealing largely with Injuries and Benefits due to Insects, but treating also such interesting topics as Metamorphoses, Care of Young, Food, and Homes; Vol. II chiefly taken up with Insect Societies, but including letters on Weapons, Movements, Emission of Sound and Light, Hibernation, and Instinct; Vols. III and IV were systematic and supplementary; these ceased to be reprinted after the sixth edition, and Vols. I and II came to constitute the now world-famed Introduction.

And what a transformation it effected! Just look before and after. A little over a century before, and the sanity of Lady Glanville had been hotly impugned by British lawyers and the great naturalist Ray dragged to court to testify that the lady, though indeed a collector of Lepidoptera, was not insane.

In the first decades of the 19th century ignorance was widespread and prejudice strong against entomology; but the "Introduction" changed all that, and in a preface to the sixth edition (1843) the authors (Kirby, now an octogenarian) could congratulate themselves on the removal of this public reproach. Moreover, a

number of other works now supplemented their popular Introduction.

In 1815 they had enlisted in their service the genius of a Government clerk, John Curtis, who drew and engraved five plates to illustrate their first two volumes. In 1824, when the "Introduction" was complete, he dedicated to William Kirby the first of his 16 immortal volumes of plates, illustrating British insects on their food plants; the letterpress is of no value now, but the coloured plates remain the *ne plus ultra* of artistic excellence. And the great systematist, J. O. Westwood, won the favour (his crowning ambition, he calls it) of having his magnificent "Introduction to the Classification of Insects" recognised as a sequel to Kirby and Spence; and so it became and is.

The authors of the "Introduction" claim as one of the advantages of their epistolary method that it lends itself to easy digressions. May I close my letter with a little aside in the shape of a personal incident? In 1904 I was visiting an uncle in Chislehurst (Kent, England), and, on the eve of my departure to Scotland on a botany trip, got word that an old family friend of my uncle's was coming to stay with him. I begged my uncle to ask his guest's advice in the choice of a good general treatise on Entomology. A week later I got a note saying that nothing in English had yet displaced Kirby and Spence's Introduction with J. O. Westwood's two volumes on Classification as a sequel. I still treasure the note with its signature—Avebury; for my uncle's friend was none other than the famous author of "Bees, Ants and Wasps," the late Sir John Lubbock.

Æshna umbrosa umbrosa Walk. in Newfoundland.

In the 45th Annual Report Ent. Soc. of Ont., 1914, p. 149, I recorded the finding of the nymph of this dragonfly at Spruce Brook, Newfoundland, on July 27, 1914. Recently I received two male adults from Humbermouth, Bay of Islands, Nfd., taken on August 11, 1915, by Dr. A. G. Huntsman, of the Biological Dept., University of Toronto. They were captured while flying in the vicinity of a small creek flowing partly through dense spruce woods and partly through a natural meadow. These specimens resemble some which I have from Anticosti, being somewhat stouter and a little smaller than usual, this being a general characteristic of the species of Æshna from Newfoundland and other localities having a cool summer climate.—E. M. Walker.

NOTES ON STAUROPHLEBIA RETICULATA BURM.

BY E. M. WALKER, TORONTO.

Mr. E. B. Williamson, of Bluffton, Ind., recently placed in my hands for study a series of the large Aeshnine dragonfly, *Staurophlebia reticulata* Burm., taken by himself, his father (the late Mr. L. A. Williamson) and Mr. B. J. Rainey in four localities, viz., Los Amates, Guatemala; Baracon, Chaquamas, Trinidad; Rockstone, British Guiana, and Tumatumari, British Guiana.

On handing over the series to me, Mr. Williamson called my attention to the marked difference in coloration between the British Guiana specimens and those from the other localities, and stated that this difference was much more conspicuous in the living insects, being readily recognizable during flight. It seemed, therefore, desirable to make a careful study of the material in order to determine, if possible, the systematic status of the two colour-forms.

While pursuing this object, I have also taken the opportunity of studying the mutual adaptation between the peculiarly specialized structure of the male abdominal appendages and the correlated parts of the head and prothorax of the female, which are held by these appendages during copulation; especially in view of Mr. Williamson's observations on the habits of this species during the copulatory act (*vide inf.*)

Coloration.

On the envelope containing one of the males from Rockstone, British Guiana, is the following field-note: "Thorax and head bright grass green, segments 1 and 2 similar, shading into yellowish; 3-9 golden-brown, clearest on each segment anterior to transverse carina; posterior to transverse carina shaded into brown; 10 largely yellow."

With one of the Trinidad specimens is the following note:—

"Colours like British Guiana specimens, but abdomen distinctly bluish-green, very different from British Guiana specimens, so much so that colours in flight are very different."

The Guatemala specimen bears the following note:—

"Eyes bright green, face greenish-blue, thorax dull green, abdomen after transverse carina on 3 dull blue."

The colour-characters of the males as seen in the dried specimens may be tabulated as follows:—

British Guiana	Trinidad	Guatemala
Face grass green.	Face grey-bluish green.	Face grayish olivaceous.
T-spot, with distinct narrow stem.	T-spot with distinct narrow stem.	T-spot reduced to a narrow streak along frontal margin, no stem.
A dark brown line on fronto-nasal suture and base of labrum.	A dark brown line on fronto-nasal suture, sometimes faint and base of labrum.	Such lines not distinctly present.
Thorax grass-green, a chocolate streak in front of antealar sinus and extending along base of mid-dorsal carina.	Thorax of a darker and colder or more bluish-green with similar markings.	Thorax dark reddish-brown, with a dull greenish bloom (dull green in life), scarcely darkened in front of antealar sinus and base of median carina.
Green colour of thorax extending on abdomen not beyond sides of seg. 1, shading into ochre yellow on 2 and base of 3, posterior to which abdomen is orange-brown, darker on each segment behind transverse carina (golden-brown in life).	Green colour of thorax extending on abdomen to transverse carina on 2, distal part of 2 and 3 front of transverse carina reddish-brown, shading into dark-greenish brown on the remaining segments (bluish-green in life).	Abd. segs. 1 and 2 apparently concolorous with thorax. Seg. 3 anterior to transverse carina clear reddish-brown, shading into dull dark greenish-brown in the remaining segs. (dull blue in life).

The females in the dried condition are similar in colour to the males from the same localities. In those from Trinidad the brown line on the fronto-nasal suture is faint, as it is in some of the males.

Structural characters.

A careful search was made for structural characters particularly in the genitalia of both sexes, the abdominal appendages of the male and the wing-venation. The results were entirely negative, except in the venation, and even here no constant differentials were found, nor anything approaching such characters. All that could be detected was the presence of slight differences in the average number of certain cross-veins, cells, etc., as shown in the table below. Only the males from British Guiana and Trinidad were in sufficiently large series to be used for this purpose.

In this analysis the following characters were specially noted and tabulated:—

1. Number of first antecubital veins.
2. Number of first postcubital veins.
3. Number of cubital cross-veins.
4. Number of cross-veins in the triangle.
5. Number of cross-veins in the supratriangle.
6. Number of marginal cells between Rs and M_3.

7. Number of irregular postcubital cells just beyond nodus; i.e., those formed by the apparent prolongation of the subcosta.

8. Number of cells in the anal loop.

9. Number of cells covered by pterostigma.

10. Maximum number of rows of cells between Rs and Rspl.

11. Maximum number of rows of cells between Ms and Mspl.

12. Position of origin of Mia in relation to first postcubital cells.

13. Position of fork of Rs in relation to first postcubital cells.

The results from 7, 9, 10, 11 and 12 were negative. Those of the other numbers are given in the following table:—

Antecubital Veins			Postcubital Veins			Marginal Cells between Rs and M3			Cross-veins in triangle			Cross-veins in supra-triangle			Position of fork of Rs (No. of cells before stigma)		
No. of v'ns	No. of wings		No. of v'ns	No. of wings		No. of c'ls	No. of wings		No. of v'ns	No. of wings		No. of v'ns	No. of wings		No. of c'ls	No. of wings	
	B.G.	Tr.		B.G.	Tr.		B.G.	Tr.		B.G.	Tr.		B.G.	Tr.		B.G.	Tr.
Fore wings			Fore wings			Fore wings			Fore wings			Fore wings			Fore wings		
24	1	0	19	0	1	36	0	1	4	1	2	6	2	1	5	0	2
25	1	1	20	0	1	37	0	0	5	7	6	7	1	5	6	2	2
26	0	2	21	0	3	38	1	1	6	10	4	8	8	5	7	7	6
27	1	4	22	4	1	39	1	3	7	2	0	9	8	1	8	6	1
28	2	2	23	3	2	40	4	2	Hind wings			10	1	0	9	3	1
29	2	2	24	3	2	41	5	0	3	0	1				10	2	0
30	4	0	25	4	1	42	4	1	4	4	8	Hind wings			Hind wings		
31	6	0	26	4	1	43	3	1	5	12	3	4	0	2	7	1	4
32	1	1	27	1	0	44	0	1	6	4	0	5	3	7	8	3	4
33	1	0				45	1	1				6	13	3	9	8	1
34	1	0										7	4	0	10	6	1
Hind wings			Hind wings			Hind wings			Cubital Cross-veins						11	2	1
17	1	0	21	0	1	39	0	3	Fore wings			Cells in Anal loop					
18	1	1	22	0	1	40	0	1	4	2	0						
19	1	5	23	0	0	41	3	0	5	2	7	12	1	2			
20	4	6	24	4	2	42	3	1	6	13	5	13	2	1			
21	5	0	25	2	3	43	2	0	7	3	0	14	3	4			
22	4	0	26	5	2	44	3	2				15	4	3			
23	4	0	27	4	1	45	3	2	Hind wings			16	9	2			
			28	2	2	46	2	2	3	1	3	17	0	0			
			29	0	0	47	2	0	4	16	9	18	1	0			
			30	2	0	48	1	0	5	3	0						
			31	1	0												

In this table B. G. = British Guiana (Rockstone) and Tr. = Trinidad (Baracon). Ten males from the former locality and six from the latter were studied, so that the total number of fore or hind wings was 20 from British Guiana and 12 from Trinidad.

It will be seen from the table that in nearly every case the prevalent number of veins or cells is slightly greater in the British Guiana specimens than in those from Trinidad. In the former, e.g., the number of antecubital veins most often noted is 31 in the fore wings and 21 in the hind wings, while in Trinidad specimens the corresponding numbers are 27 and 20. Similarly in the case of the postcubital veins, the prevalent numbers for the British Guiana specimens are 22 and 26 for the fore and hind wings, respectively, while for the Trinidad specimens they are 21 and 25. The difference is too slight to be conclusive for any one table, but when taken together the results seem to indicate fairly clearly a slightly greater average complexity of venation in the British Guiana specimens than in those from Trinidad.

The Guatemala specimen is well above the average in complexity of venation, but it is impossible to judge from a single specimen how this form compares with the other two in this regard.

In view of the apparent absence of distinctive structural characters, it is improbable that there is more than one species represented in this series. But there are at least two strikingly different types of coloration characteristic of different localities, and it, therefore, seems best to regard these as geographical races. The Guatemala specimen, not being identical with either of the South American forms may be considered for the present as the type of a third race.

The type locality of Burmeister's *Aeschna reticulata* is Surinam and the British Guiana form may therefore be considered the typical race. This is also suggested by the expression "viridi-flava," which occurs in Burmeister's description quoted below.

Staurophlebia reticulata reticulata (Burm.)

Burmeister's description (Handb. der Ent., 1839, p. 837) is as follows:[1]—

"5. A. reticulata; viridi-flava, post mortem sæpius fusca, tibiis intus nigris, alarum venis nigris, cellulis fusco-limbatis, Long. 3¼."

1. Kindly quoted for me by Mr .E. B. Williamson.

"♂. cercis foliaceis, in latere interno basi apiceque gibbiferis s. auritis.

"Aus Surinam, in Sommers Sammlung,"

Staurophlebia magnifica Brauer from Brazil is probably a synonym of this form.

The specimens in the series studied are labeled as follows:—

Rockstone, British Guiana, Feb. 2, 1912, 2 ♂'s; idem, Feb. 12, 1912, 7 ♂'s; idem, Feb. 14, 1912, 4 ♂'s, 2 ♀'s.

Tumatumari, British Guiana, Feb. 9, 1912, 1 ♂.

These specimens measure as follows:—

Males—Length of body, 94.5-100 mm.; of abdomen (including appendages) 73-78 mm.; of hind wing 62-65 mm.

Average measurements of 11 males—Body 96.6 mm.; abdomen 74.8 mm.; hind wing 63.2 mm.

Females (appendages broken in one specimen)—Length of body 92-94 mm.; length of abdomen (excluding appendages) 64-69 mm.; length of hind wing 63-64 mm.; length of appendages 6.5 mm.

Staurophlebia reticulata obscura, n. subsp.

Under this name I include all the specimens in the series from Trinidad. They have been sufficiently characterized above.

These specimens consist of 7 ♂'s and 3 ♀'s from Baracon, Chaquanas, Trindidad, all dated March 7, 1912.

The 6 ♂'s and 2 ♀'s examined measure as follows:—

Males—Length of body, 92-98 mm.; of abdomen (including appendages) 71-76.5 mm.; of hind wing, 60-66.5 mm.

Average measurements of 6 ♂'s—body 94.4 mm.; abdomen 73.5 mm.; hind wing 63.5 mm.

Females—Length of body 88.5-97 mm.; of abdomen (excluding appendages) 63-68.5 mm.; hind wing 65.5-71 mm.; appendages 6.5-7 mm.

Staurophlebia reticulata guatemalteca, n. subsp.

The single specimen of this form examined is a male from Los Amates, Guatemala, taken by Mr. Williamson, on June 21, 1909. It may not represent a valid race, but cannot properly be placed with either of the other two.

The specimen measures as follows:—

Length of body 99 mm.; of abdomen (including appendages) 76 mm.; of hind wing 67.5 mm.

Mutual Adaptation of the Sexes.

I have noted elsewhere* that in *Aeshna constricta* and its allies the abdominal appendages of the male are specialized for a firmer grasp of the head and prothorax of the female than in those species in which these structures have their usual form, and that these modifications are probably correlated with the more erratic nuptial flight of the species of this group. In *Staurophlebia* the general form of the male superior appendages recalls that of *Aeshna constricta*, but is still more highly specialized, having in addition to a very prominent subapical denticulate crest formed by the extreme elevation of the distal part of the superior carina, and the bending upwards of the margin at its termination, a process from the dorsal surface and supero-external margin, just before the middle, directed horizontally inwards and slightly decurved at apex(pl.XVII.,fig.1*h*). The inferior appendage is also complicated by the presence of a prominent elevation rising almost perpendicularly from the superior surface of the appendage at its extreme base (fig. 1, *b. inf.*).

The appearance of these appendages suggests a very firm union between the two sexes during copulation, and it is therefore of interest to learn from Mr. Williamson's notes that the nuptial flight is very erratic.

I relaxed the separated abdomen of a male and the head and thorax of a female, and endeavoured to determine the exact nature of this union. This was an easy matter as far as the head of the female was concerned, but with regard to the prothorax, much careful manipulation was necessary. I think, however, the following account will prove substantially correct.

By applying the upper surface of the inferior appendage to the front of the head in the usual position for the Aeshninæ the basal elevation was found to fit accurately in a depression on the rear surface of the female's head just below the occipital margin (fig. 1, *b. inf.*). This feature alone must render the grasp of the male firmer than in those species which lack the prominence. The superior appendages also fell naturally into position at the rear of the head on the slope of the concavity surrounding the occipital foramen, from which their inner margins were but narrowly

*1912, Walker, E. M., Univ. Tor. Stud., Biol. Series 11, pp. 38-42.

separated. In this position they were divergent at an angle of about 35°. The laterally situated apices occupied a position adjacent to the inner surface of the base of the cardo, or first joint of the maxilla (fig. 1, *mx.*).

When the exact position of the prothorax in relation to the head is observed, it will be seen that the posterior margin of the pronotum approximately coincides with the position of the hook-like processes rising from the upper side of the male superior appendages, and there seems little reason to doubt that in copulation these processes hook over the pronotal margin as shown in figs. 1 and 2. The expanded part of the appendages enclose the pronotum, the crest-like elevations of the superior carinæ, which are directed inward, passing beneath and completing the pair of claspers. They appear to fit in a deep depression on the side of the pro-epimerum.

Thus the grasp of the male appendages as compared with those of Æshna, etc., is complicated and strengthened by the following specializations of structure:

(a) The basal protuberance of the inferior appendages, serving to support the occipital region of the head.

(b) The hook-like processes of the lateral margins, supporting the hind margin of the pronotum.

(c) The unusual development of the subapical denticulate crest, serving to grasp the neck immediately in front of the pronotum.

Notes by E. B. Williamson.

The first *Staurophlebia* I ever saw came sailing along the railroad track below Los Amates, Guatemala, one sunshiny morning (June 21, 1909) after a heavy night's rain. As he came towards me, I saw him at some distance, a gigantic fellow flying now within a few feet of the ground and now high up in the air, but following the lane or slash made by the railroad through the jungle. As he raised to pass me, the impression was of a dull, dark insect which might be brown or obscure blue or green. To our mutual surprise a despairing, straight backward high-reached sweep of the net overtook him. This was the only specimen I saw in Guatemala during two collecting trips.

On the morning of January 31, 1912, I followed the log-filled stream back of the rest house at Rockstone, British Guiana, for a mile or two. On two occasions I saw for an instant a large brilliant green and golden-brown æschnine which cut across the stream, with only a moment's hesitation above the water. About 1 p.m. my father and I were at the stream, when we saw it again, but this time flying a beat, possibly 75 or 100 feet long. It disappeared over the trees as I approached, and we decided it was some glorified *Anax* to be found at home possibly at some neighbouring pond. The next day father and Mr. Rainey made a search for such a pond, while I again collected on the creek. Their search for a pond was in vain, but they found the home of our shy acquaintance of the day before in a small shallow muddy creek bed, in the woods, and without running water, there being merely pools of greater or less extent.

They saw several specimens, got several fair strokes at the dragonflies and affirmed that in striking from the rear at the dragonflies they were unable to make the net overtake the insect. The next day I visited this creek bed just below the town on the same side of the river. Never have I seen a dragonfly apparently more out of place—the little muddy wet-weather creek, in some places with the jungle crowding it to a scant 2-foot width, with its obscure, leaf-filtered sunlight on dry or damp mud banks and isolated pools of dirty water—and back and forth in this narrow avenue, from shade into sunlight and back into shade again, a great green and golden æschnine which so clearly belonged to the sunny reaches of marsh or lake. After a few futile strokes I caught one, and then another, and *Staurophlebia* does not take its capture tamely or philosophically. They fought, tearing and biting, and attacked the fingers which drew them from the net.

Staurophlebias were seen only rarely elsewhere in British Guiana, and then only along smaller streams. None were seen the two days I collected in Dutch Guiana. On March 7, 1912, Mr. Rainey and I were accompanied by Mr. F. W. Urich to Baracon, Chaquanas, Trinidad. We found the woods near there very dry with the stream beds in many cases without any water. Along such a stream bed we found a dark bluish or greenish dragonfly flying. Till specimens were captured it never occurred to me that

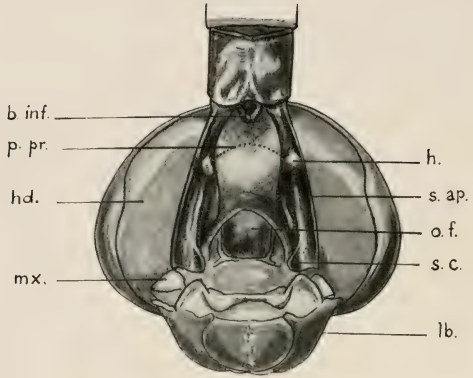

Fig. 1

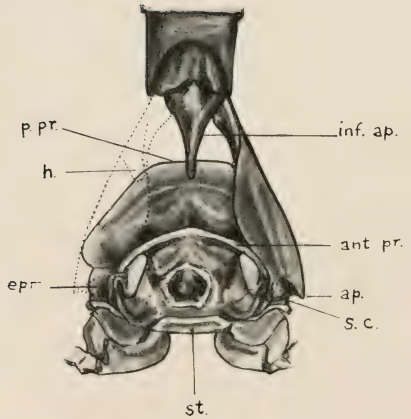

Fig. 2

STAUROPHLEBIA RETICULATA Burm.

Copulatory Position.

it was the same species we had recently seen in British Guiana. Its appearance was entirely different and the general colour and habits were in keeping with the surroundings which were not strikingly different from those of British Guiana.

On several occasions I saw the male seize an ovipositing female as she thrust her ovipositor in the damp but hard soil. So occupied, the male would find her as he came swiftly along the creek bed. Without hesitation he would plunge down on her, when the liveliest tussle would take place, the two tumbling over and over on the ground among leaves and other debris with a great rustling of wings and a general commotion that indicated a life and death struggle. When the male succeeded in fastening his appendages on the female's head a wild nuptial flight to a great height and distance immediately took place. Females, presumably the same, after a short time returned again to the same spot to oviposit. Such females were more or less stained and sticky, and we believed that in the pre-copulatory conflicts with the males the abdominal integument had been torn at a number of places with a resulting leakage of body fluids.

Explanation of Plate XVII.

Fig. 1. *Staurophlebia reticulata* Burm., rear view of head of female, clasped by abdominal appendages of male; *hd.* rear of head; *mx*, maxilla (cardo); *lb.*, labium; *of*, occipital foramen; *s. ap*, superior appendage of male; *h.*, hook-like process on upper side of superior appendage; *s.c.*, elevated distal part of superior carina; *b. inf.*, basal prominence of inferior appendage; *p. pr.*, position of posterior margin of pronotum.

Fig. 2. *Staurophlebia reticulata* Burm., front view of prothorax of female, clasped by appendages of male; *st.*, prosternum; *epm.*, pro-epimerum, showing depression in which the superior appendage fits (this is slightly out of place on the right side); *ant. pr.*, anterior margin of pronotum; *p. pr.*, posterior margin of same; *ap.*, apex of superior appendage; *inf. ap.*, inferior appendage; other lettering as before.

AN EARLY REFERENCE TO THE RELATION OF INSECTS TO DISEASE.

BY C GORDON HEWITT, DOMINION ENTOMOLOGIST, OTTAWA, ONT.

In studying the evolution of ideas respecting the control of insect pests, I came across an early reference to the relation of insects to disease which is of interest more from an historical point of view than as a serious contribution to the development of the insect transmission theory of disease. Nevertheless, I believe it is worthy of a place among our entomological documents, and this is one of my reasons for calling attention to it. The other reason is the relation it has to the ideas advanced by Nott (1848) on the mosquito transmission of yellow fever by insects. Nott has been generally accorded the credit of having formulated the insect-transmission idea of yellow fever. Riley (1914)* however, has recently pointed out that when Nott's argument is studied in its entirety it does not support the conclusion usually claimed, but that the term "insect" was used to denominate micro-organisms in general. As the matter is fully discusssed by Riley in his paper, I will not repeat his interesting statements here. In the quotations which I am about to give I do not think that there is any ambiguity about the meaning of the term "insect."

In an old volume entitled "New Improvements of Planting and Gardening, both Philosophical and Practical," by Richard Bradley, F.R.S., the fourth edition of which was published in London in 1724 (this is the edition from which the extracts which follow are made) the author quotes a letter from a "worthy Gentleman, Mr. Balle," which begins (page 254):

> Upon discoursing with you some time since about Blights upon Trees, you seem'd to be of the opinion that they were the Effect of Insects brought in vast Armies by the Easterly Winds and by lodging upon the Plants proper for their Nourishment, they there produced that Distemper which is called a Blight or Blast.
>
> You was then desirous of what Observations I had made concerning Pestilential Distempers subject to Mankind, which

*Journal of Parasitology, I, p. 37, 1914.

I believ'd to proceed from the same Cause that produced Blights, i.e., from Insects; I have therefore, in answer to your Request endeavour'd to recollect what I have from time to time observ'd relating to that Case.

After five pages of miscellaneous discussion which concludes with the belief "that the most nauseous Vapour of itself will not cause any Distemper that is Epidemical," the letter continues:

It seems that the Plague proceeds from some other Cause, and that I suppose to be Insects of thatextraordinary smallness that they are not to be discern'd by the naked Eyes; they are so light that they float in the Air, and so are suck'd in with the Breath. Such insects not being among us commonly, but only when they are either brought to us from some remote place by the Wind, or hatch'd or nourish'd by some Intemperance of Air or from poisonous Vapours rising from Boggs, Ponds, Ditches or some such unwholesome Funds of stagnating Water.

These Insects are various, according to the Nature of the Water or Air they are bred in; their Eggs being first laid by some flying Animals, which are then hatch'd, and passing through the several Changes common to Insects, at length take Wing; and being drawn in with the Breath, may perhaps be either kill'd in our Bodies and cause violent Ferment in the Juices, or else finding proper Nourishment, they breed in the Lungs, Stomach, or other parts within us, and probably may occasion those Biles and Breakings out in the tender parts of the Body that are called Plague-sores.

But these Insects, are some of them so extremely small, that they are only capable of being discern'd with good microscopes; and when they are winged, and so quite perfected, may perhaps in Swarms be carried from one Country to another by the Wind: It is Insects of several Kinds and Colours, which causes the Surface of Waters to appear sometimes Green, Red or Black; which last Colour in Water is observ'd by the Herdsmen to poison the Cattle that drink of it; and

they say causeth the Murrain, which is the Plague in Cattle, and it is very infectious.

It has been observ'd that Plagues, and the most contagious Distempers, have commonly happen'd in those Years when the Easterly Winds have more than ordinary prevail'd in the Spring and Summer Seasons; then the Air comes to be infected, and rarely or ever at other times. These Winds we see bring Caterpillars, and many differing Insects and Flies, which meeting with places fitly adapted to nourish them they are there brought to their winged state, which I conceive is the same in the invisible Animals as in the visible; nor indeed in any part of the Earth, or Waters.

The west winds he considered, carried back "the remainder of these Pestiferous Insects which yet survive, to the Country from whence they came." He continues:

I have not yet found that any Winds, except the East Winds, such as pass over Tartary, bring any Infection with them, nor have I ever heard of Pestilential Distempers in any part of the World, unless in such places only where the Tartarian Winds reach; Tartary being a country full of Woods, Boggs, and Fens it seems the most capable of producing these Creatures in abundance, which may be carry'd by the Wind to certain places in search after their Food, as are Locusts and some certain Birds, which are know to pass from one Country to another.

* * * * * * * * * * *

Experience shews us how much Insects delight in stinking Places, and that they increase much faster in uncleanly Cities, such as London was formerly, than in cleaner Places; but the city of London having been for the most Part burnt the year after the Pestilence, its streets were enlarg'd, many drains were made and good Laws were put in execution for keeping the City clean, and it has not had any Plague ever since.

* * * * * * * * * * *

His reference to the occurrence of "Epidemical Distemper" in Leghorn contains the following:

To the Northward of the Town, towards the Sea-shore, lay very boggy stinking Ground: These Marshes commonly about Autumn causes Agues and Fevers, which may be from vast Swarms of invisible unwholesome Insects, which rise from thence at that Season, but of a different Poison from those which cause the Plague: So the like Places about Civita Vecchia, Scandaroon, and I may mention the Isle of Sheppy likewise, seem to cause Agues. And it is observable, that from the Mouth of the River Magra, which divides Tuscany from Liguria, along the Sea-Coast of Italy, as far as Terracina, is very unhealthy, and subject to Agues and pestilential Fevers, being marshy Ground.

We may also observe that in Turkey, Egypt and Barbary, when the Plague rages, the Franks, the English, etc., are seldom infected with it, which seems to confirm my Opinion, that this Sickness proceeds from Insects, who having their certain natural Nourishments respectively appointed them, do not in those Places infect Strangers, who have differing ways of eating and living from the Natives, and are of a contrary Nature of Body. It would be well worth Enquiry, if the People of those Nations, that were in strange Countries in the Times of Pestilence were also free from Infection.

King Charles the IId when he was told of the Sickness at Leghorne, said It must have been occasion'd by the new Fortifications which were then building in those marshy Places; And it is very rational to believe, that turning up those unwholesome Muds, and exposing them to the Sun, did much increase the distemper, by infecting the Air, and filling it with greater Supplies of poisonous Insects.

Enough has been quoted of this writer, whose observations cover nineteen pages, to indicate the trend of his ideas and also to show that he was using the term insect in a specific sense and not in the general sense evidently employed by Nott over a hundred years later.

NEW FOSSORIAL HYMENOPTERA.

BY NATHAN BANKS, EAST FALLS CHURCH, VA.

Included below are descriptions of several new species of fossorial wasps of the families *Psammocharidæ* and *Philanthidæ*.

PSAMMOCHARIDÆ.

Ageniella hestia, n. sp.

Similar to *A. apicipennis;* clypeus and basal joints of the antennæ yellow; posterior margin of the pronotum whitish; abdomen partly reddish yellow on sides of the second segment, and basal part of the venter; legs partly yellow, but on mid legs the tibiæ are brown and tarsi blackish, and on hind legs black on tip of femur, all of tibia and tarsus; spurs pale. Wings scarcely darker at tip, the third submarginal higher than long, a little narrowed above, receiving the second recurrent before the middle; thorax sericeous; abdomen sessile, slender.

One male from Falls Church, Va., Aug. 30, differs from *A. apicipennis* in pale margin of the pronotum, black on middle and hind legs, heavier venation, and slightly different shape of the third submarginal cell.

Ageniella cupidelia, n. sp.

Female resembles *cupida*, but smaller, the first recurrent meeting second submarginal cell plainly before middle, and antennæ shorter, the second and third joints together hardly equal the vertex width. Head and thorax bluish green, abdomen blackish, shining, few long hairs on clypeus and vertex, and tip of the abdomen. Legs black, inner spur of hind tibia one-half the length of the metatarsus; fore wings blackish, third submarginal all long below, much shorter above, receiving the second recurrent at middle; second submarginal plainly shorter than the third, receiving the first recurrent plainly before middle.

Length 7 mm.

From Ridgeway, Ont., Can., July 9 (Van Duzee).

Ageniella tenella, n. sp.

Male black, slightly sericeous, spurs pale, anterior tibiæ and tarsi pale, and sometimes pale on mid and hind legs; abdomen rather

brownish black, hind margins of segments faintly reddish. Body very slender, abdomen sessile; wings faintly dusky, basal transverse veins of fore wings disjointed; second submarginal longer than broad, receiving first recurrent at middle; third submarginal higher than long, narrowed above, receiving the second recurrent before middle, latter vein faintly bent out in middle; these cells nearly as in *atrata*, but in that species the second recurrent is received at middle and the discoidal is consequently longer.

Length 5.8 mm.

From Niagara Falls, July 31, and Boston, Aug. 1, both N. Y. (Van Duzee). Differs from *A. atrata* in white spurs, and more slender body.

Priocnemis hesperus, n. sp.

Very similar to the Eastern *P. subopacus*, the marginal cell blunt at tip as in that species. It is separated by the coarsely striated metanotum. It is black, with few long hairs on vertex and mesonotum, none on the face, pronotum nor metanotum, but some on the venter and apex of the abdomen The vertex and the ocellar triangle are broader than in *P subopacus*, the eyes not being as much approximated as in that species; the abdomen is more shining than in *P. subopacus*. The wings are deep black, the venation like that of *subopacus*, but the outer side of marginal cell is more angulate rather than rounded; size the same.

From Stanford Univ., Calif. (Doane).

Priocnemis fortella, n. sp.

This is close to *P. fortis*, but differs in pale wings, much smaller size, in the still shorter antennæ, and longer hind spurs. The body is black and densely hairy, the face and ocelli about as in *P. fortis;* the antennæ short and thick; the fourth and fifth joints hardly twice as long as broad (three times or more in *fortis*); metanotum striate as in *fortis;* the hind tibia, even in female, still less serrate than *fortis*, the serrations scarcely distinguishable; the inner spur of the hind tibia fully one-half the length of the metatarsus (in *fortis* scarcely one-half the length of the metatarsus). Venation about the same, the veins extending out to the margin; the fore wings are scarcely darkened (deep black in *fortis*).

Length 10 mm.

From Great Falls, Va., June 12, 29.

PHILANTHIDÆ.

Cerceris nigritulus, n. sp.

Male very similar to *C. nigrescens* Sm., but distinct by dark stigma. Markings as in *C. nigrescens*, rather more yellowish, but in only specimen seen no spots on pronotum, nor on basal segment of abdomen, and ventral marks nearly obsolete. The face broader, or rather not so long as in *C. nigrescens*, the clypeus broadly, evenly rounded below, and very strongly convex in the middle, so that when seen from the side it is plainly protuberant, hair lobes not as broad as in *C. nigrescens*, punctation and enclosure as in *C. nigrescens;* pygidial area not as in long as in *C. nigrescens*, and with nearly parallel sides. A size smaller than that species.

From Colden, N. Y, July 3 (M. C. Van Duzee). In my table it runs to 24, and of the species there included it is nearest *C. nigrescens*, but differs from all in dark stigma.

Cerceris dakotensis, n. sp.

Female black; base of mandibles, spot on the clypeal process, large spot each side of face near the eyes, small spot each side on pronotum, tegulæ, postscutellum, broad band on second abdominal segment (slightly narrowed in the middle), narrow bands on other segments (broader at sides), yellow. Legs rufous, or yellowish, front and middle femora dark at base; basal half of antennæ yellowish, or rufous beneath, tip rufous behind. Body moderately coarsely sculptured, clypeal process longer than broad, narrowed toward tip, not horizontal, but very much deflected; enclosure rather strongly striate all over; abdomen slender, basal segment only a little more than one-half as wide as the second at tip; others not wider than the second; pygidial area very long, with subparallel sides. Wings plainly fumose, darker at costal tip, stigma yellowish.

Male similar in size to the female, and the abdomen also slender; face below antennæ all yellow, other marks as in female, small lateral spots on venter yellow; and one specimen shows spots on the metanotum and first abdominal segment; large dark spot near tips of hind femora, and faint dark mark near tips of hind tibiæ. Last joint of antennæ slightly curved, third joint not as long as fourth and fifth together. Clypeus slightly convex in the middle, the anterior margin here black, and with three teeth; clypeal hair

lobes about one and one-half their breadth apart, pygidial area coarsely punctate, sides parallel, about one and a third times as long as broad; enclosure as in female.

Length 11 mm.

From Fargo, N. Dak., July 7 to Sept. 6 (Stevens coll.), on *Solidago serotina*. In Swenk's table it runs to *imitatoria*, but in that species the band on the second segment is no broader than the others.

Cerceris floridensis, n. sp.

The male runs to *C. morata* in my table, but larger, the hair-lobes of clypeus much narrower, and the enclosure different. Head broad, face reddish, clothed with white hair; clypeus prolonged in middle, the hair lobes small, fully three times their width apart; antennæ pale on base, and extreme tip; vertex and back of eyes reddish, pronotum, tegulæ, spot beneath on side, scutellum, postscutellum, large spot on sides of metanotum, first and second segments of abdomen above and below, reddish or yellowish red; legs mostly yellowish red. Wings blackish, marginal cell black, stigma yellowish; second submarginal twice as long as high. Body very coarsely punctate, enclosure large, smooth, faint traces of striation. Abdomen broad, basal segment much broader than long, but little more than one-half as wide as the second. Pygidial area hardly one half as wide at tip as at base, once and a half as long as broad at base, coarsely punctate. Last joint of antenna longer than preceding, curved.

Length 14 mm.

From Gulfport, Fla. (Reynolds). In general it is related to *C. gnarina*.

Cerceris carrizonensis, n. sp.

In the New Mexico table this runs to *C. convexus;* it differs in the marginal cell being not black, but hyaline, and in lacking a spot on pleura behind the tubercles.

Male small, black, face below antennæ yellow, enclosing a black dot each side at angle of clypeus; basal joint of the antennæ yellow, next black, beyond brown. Two spots on the pronotum, tegulæ, two spots on the scutellum, the postscutellum, band across basal segment, rather narrow band at apex of each of the other segments.

Legs yellow, mid femur black on base, hind femora with large black spot near the tip, hind tibiæ also with black spot near tip; hind tarsi dark. Wings infuscated, but not very dark, the stigma dark brown, marginal cell no darker than rest of the wing. Body not very coarsely punctate, face with dense white hair, clypeus slightly, evenly convex; hair lobes rather broad, hardly one and a half their breadth apart; antennæ short, last joint short, not curved. Enclosure roughly punctate, no striation. Abdomen short, hardly longer than thorax, basal segment narrow, longer than broad, not one-half the width of the second segment; pygidial area not much wider at base than at tip, not one and a half times as long as broad; in the wings the first recurrent runs into second submarginal cell before middle. Body densely long haired, especially noticeable on the thorax, the hair here twice as long as in most species.

Length 6 mm.

From Walde, Texas.

Eucerceris apicata, n. sp.

Male reddish, face yellow up to the ocelli; the pronotum, scutellum, postscutellum, two oblique spots on the enclosure, tegulæ, tubercles, two large spots on pleura below tegulæ, large side spot on the metathorax, all yellow. On the anterior part of the mesonotum are four yellow streaks, and between them the surface is blackish. Abdomen yellow, the narrow basal part of each segment reddish to blackish; venter with yellow side spots on the basal segments. Legs reddish, with yellow on front of the femora and tibiæ of anterior and middle pairs. Wings hyaline, a dark cloud from the second submarginal and marginal cell out to tip, this spot not extending basally. Body rather coarsely punctate, but the enclosure smooth; third and fourth ventral segments with erect row of yellow hairs. Related to *E. canaliculatus;* the second submarginal cell more quadrangular, and the smooth enclosure distinctive.

Length 11 mm.

From Yuma, Arizona.

Philanthus assimilis, n. sp.

Male close to *P. bilunatus;* thorax and abdomen smooth as in that species, enclosure with the pit as in *bilunatus.* Markings about

as in that species; the middle face-mark, however, is much larger and broader below, and at this point the head is more protuberant than in *P. bilunatus;* there is a spot behind eye, and below tegulæ, yellow. Abdomen with the first segment showing two small spots, the second segment with a very broad band, almost divided in the middle; third and fourth bands narrow, and emarginate each side in front. Last segment more emarginate than in *P. bilunatus*. Legs with femora (except tip) black, rest of legs yellow. Wings infuscate, rather broader than *P. bilunatus*, the third submarginal as broad as long; vertex broader than in *P. bilunatus*.

Length 10 mm.

From Boston, N. Y. (Van Duzee).

Philanthus subversus, n. sp.

Male—Face yellow, an oblique black streak up from the base of the antenna, connecting to the black vertex; malar space and the mandibles (except tip) yellow; basal three joints of antennæ yellow, rest rufous, darker above, second joint with a black dot above; vertex with curved yellow band and long streak back of eye (as in *sublimis*), collar, tegulæ, tubercles, most of pleura, four short streaks on anterior part of mesonotum, two spots on scutellum, and spot each side of it toward base of wing, postscutellum, two oblique spots at side of enclosure, large side stripes on mesonotum reaching down on pleura, all yellow. Abdomen with broad spot each side nearly meeting above; other segments with bands, very broad on the sides, triangular median incision in front of second, emarginations on other bands, last segment all yellow; venter almost all yellow, with two black bands. Wings faintly fumose, stigma yellow, veins brown; legs yellow, last joint of tarsus rufous. Head minutely punctate, the clypeus nearly smooth, acutely produced in the middle below; thorax sparsely punctate, collar and the postscutellum smooth, metathorax more densely punctate; enclosure finely, transversely striate; abdomen broad, rather coarsely punctate, last segment smooth. In wing the third submarginal cell no broader above than second, basal sides of the second submarginal cell subequal.

Length 8.5 mm.

From Palmerlee, Arizona (Biederman).

Philanthus vertilabris var. **completus,** n. var.

Male similar in markings to type, but the bands of abdomen beyond that on the second segment are all much broader than in normal eastern form. Sculptured as in typical form; the upper yellow face mark much larger than *vertilabris*, and its upper edge not so much emarginate; in the wings the second submarginal cell has its upper basal side twice as long as the lower basal side. In the new Mexico table it runs to *P. cockerelli*, from which it is separated by different markings.

Length 12 mm.

From San Diego Co., California (Van Duzee).

FIELD NOTES AND QUESTIONS.

Migrating Notes on the Milkweed Butterfly, *Anosia plexippus.*

BY F. M. WEBSTER, WASHINGTON, D. C.

For a number of years the writer has been able to record the banding together of this butterfly as observed by him at various points in the United States. Supposedly these gatherings are preparatory to the annual southward autumnal migration of the species.

The present year, 1915, my son, R. L. Webster, observed one of these gatherings near Ames, Iowa, on August 30th; an exceptionally early record, as such assemblings together do not usually occur until September or October.

The writer observed a swarm of these butterflies near Waterman, DeKalb County, Illinois, on September 18, a little north of the latitude of Ames, but some two hundred and seventy-five miles farther east.

It would seem that there is no general uniformity in the dates of the congregating together of these detachments and it would be exceedingly interesting to learn just what laws, if any, regulate the collecting together and of the different swarms, and if they resemble in any way the systematic migrations of birds.

BOOK REVIEWS.

THE MOSQUITOES OF NEW JERSEY AND THEIR CONTROL. By Thomas J. Headlee, Ph.D. Bull. No. 276, New Jersey Agricultural Experiment Stations. Issued Jan. 30, 1915. 135 pp., 94 figures.

The notoriety of the New Jersey mosquito is known to all, and probably every American entomologist has some acquaintance with the extensive work that has been done by the New Jersey Agricultural Experiment Stations, under the direction of the late Dr. J. B. Smith towards the control of these really serious pests.

The present account is the outcome of a need that has been felt for a "popular, yet accurate and easily available, manual on the important mosquito life of New Jersey," the other publications on this subject issued by the New Jersey Agricultural Experiment Stations being now out of print or the supply practically exhausted.

The first pages contain a brief account of the habits, life-history, structure and classification of mosquitoes in general, in which the author lays emphasis on the importance to anyone who undertakes the control of these insects, of knowing exactly the species with which he has to deal. This is followed by tables, republished from the work of Messrs. H. B. Weiss and R. S. Patterson, for the determination of the forty species of mosquitoes, both in the adult and larval stages, that are known to occur in New Jersey.

Of these species sixteen are considered sufficiently important to be treated in some detail, while of the remainder brief notes on habits and distribution are given. The sixteen troublesome species, only six of which are regarded as first-class pests, are divided into four groups; the salt-marsh, house, swamp and woodland groups. The six members of the salt-marsh group are the species that are responsible for New Jersey's fame as a mosquito-infested state, and these species naturally receive first consideration.

The author describes at some length the methods of control of the salt-marsh mosquitoes, now in operation by the state, of draining the marshes or stocking the pools in localities where draining into the sea presents serious difficulties, with killifish (*Fundulus*), various species of which are most important natural factors in the control of these mosquitoes. Gratifying progress in

this work has already been attained, and it was found as the result of an investigation made during the summer of 1912-13 that the shore line property values between Jersey City and Rumson had increased by $5,600,000. Incidentally the drainage operations have greatly increased the production of marsh hay on the lands treated.

Next in importance to the salt-marsh group is the house group, to which the House Mosquito (*Culex pipiens* L.) and the Malarial Mosquito (*Anopheles quadrimaculatus* Say) belong. The control of these forms is considered together with that of the woodland and swamp group, the problem in all such fresh-water forms consisting in finding the breeding-places and in one way or another, according to circumstances, rendering them uninhabitable for the larvæ, either by draining, filling, stocking with fish, or, if these methods cannot be carried out, by oiling the surface or using a substance (larvicide), which will mix with the water and kill the larvæ by contact.

This excellent report is copiously illustrated, the greater number of figures having been taken from Dr. J. B. Smith's elaborate work. In addition to the figures of the various species of mosquitoes and their larval characters, the methods employed in draining the salt-marshes, characteristic breeding-places and the kinds of fish useful in mosquito control are also well illustrated.

Coleoptera Illustrata. By Howard Notman, Vol. I, No. 1. Carabidæ, 136 Joralemon Street, Brooklyn, N.Y. (Price $1.00).

This is a very peculiar little book, consisting, as it does, of fifty outline drawings of beetles, forty-one belonging to the genus Carabus, and the remaining nine to Calosoma, Damaster, Procerus and Procrustes. None of the species figured are North American. There are no descriptions, but merely an index to genera and subgenera, species and sub-species. The drawings are clear and well-executed, each species depicted occupying a single page. As there is no introduction, we are unable to form any conjecture as to the author's object in issuing this publication.

C. J. S. B

THE LONDON NATURAL HISTORY SOCIETY. From the Transactions of this Society for the year 1914, we learn that the organization has been formed by the amalgamation of the City of London Entomological and Natural History Society (founded in 1858) with the North London Natural History Society. The union has enabled the new organization to meet the war-time difficulties with a strength and resource which could not have been furnished by either of the old Societies by itself.

In addition to the official records of meetings and reports, the Transactions contain some very interesting papers. The President, Mr. L. B. Prout, in his address, discusses various theories respecting genera and species, with particular reference to Pierce's work on "The Genitalia of the Geometridæ." Mr. L. W. Newman describes his methods of collecting and breeding the Sesiidæ, which will be found useful in this country. Dr. E. A. Cockayne contributes a paper on "Gynandromorphism," in which he describes the various forms that are met with, and gives some remarkable examples. Other papers cover a wider range, such as "The Middle Ages in the Wey Valley," "British-breeding Ducks," and a short history of "The City of London Society."

THE ENTOMOLOGICAL SOCIETY OF AMERICA.—TENTH ANNUAL MEETING.

The Tenth Annual Meeting of the Entomological Society of America will be held in Columbus, Ohio, Wednesday and Thursday, December 29 and 30, and if necessary to complete programme, on Friday, December 31st, in affiliation with the meetings of the American Association for the Advancement of Science and other affiliated societies. Meetings will begin at 2.00 p.m. on Wednesday. The meetings of the American Association of Economic Entomologists will begin Monday afternoon with other meetings on Tuesday and Wednesday and Thursday evenings.

The Annual Public Address will be given on Wednesday evening, December 29th, by Dr. C. Gordon Hewitt, Dominion Entomologist, Ottawa, Canada. His subject will be "A Review of Applied Entomology in the British Empire." The entomologists of Ohio are planning a smoker for visiting entomologists, which will be held on Wednesday evening after the address.—(From Announcement.)

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